

March 16, 1959

Aviation Week

Including Space Technology

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A McGraw-Hill Publication

**Sandwich Panels
Cut Weight In
Victor Bomber**

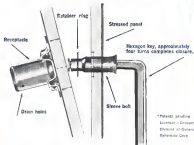


General Electric Engines

Pacific Missile Range to Play Big Tracking Role

MILSON STRESSED PANEL FASTENER...

The First Fool-Proof, Quick-Operating Panel Fastener!



For the first time, the Milson Fastener allows the stressed panel assembly to become an integral part of primary structure. For frequent removal of components with greatly reduced time, the Milson Fastener closes gaps up to .125 in., permits installation with hole misalignments up to .040 in., contains deep hexagon receipt for built-in drain holes and finger pre-load. Designed with only four parts and nothing to adjust, it provides two for and corner fastening receipt-style, is made, featured in two temperature ranges—alloy steel for 550°F and stainless resistant steel for 700°F service.

The sleeve bolt has a shear groove in the head to prevent over-tightening. This

fastener has a common hole size in the panel and substructure, and all parts are completely interchangeable.

This is the newest and only device available that provides quick access to block box equipment as often as required, even before possible with stressed panels.

Technical information for panel fastener and panel requirements available on request.

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Where
can
Rubberized
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Good strength, flexibility and portability in one lightweight material? Goodyear Rubberized Fabric may be your answer.

INFLATABLE PORTAGE

Air Mail Fabric provides equal load resistance as any heavy-duty aluminum. Ideal for portable structures, portable vaulting, shock absorbing, bumper. Made of this unique rubber-cased fabric, material here, lightest strength-to-weight ratio known.



INFLATABLE

—another important application of Air Mail Fabric. Fully portable, flexible, and strong. Do your plans call for a lightweight structural material that can be stored easily, does not require maintenance of storage space, can be erected quickly?



SOFT COLLAPSIBLE FUEL TANKS

Just insert filler in reg.—use for jet or liquid fuel. Pumping 45 minutes after delivery. Eliminates need for bulky, hard-to-handle metal drums. Designed for use wherever emergency or emergency storage of gasoline, oil, water—any bulk liquid—is required.



HOW TO BRING A MEDICAL BACK

Goodyear's Recovery Bag—made of tough rubberized fabric—fold two feet diameter, in five or six days to reduce ground impact. Saves the trouble for taking another day, eliminates cost and weight of aluminum or steel medical cases. Goodyear's Recovery Bag—made of tough rubberized fabric—fold two feet diameter, in five or six days to reduce ground impact. Saves the trouble for taking another day, eliminates cost and weight of aluminum or steel medical cases.



FOR DETAILS INFORMATION on rubberized fabric—call how it can save for you—write Goodyear Aviation Products Division, Akron 16, Ohio, or Los Angeles 34, California.

AVIATION PRODUCTS BY

GOOD YEAR

WHERE AIRCRAFT LAND ON GOODYEAR TIRES, WHEELS AND BRAKES THAN ON ANY OTHER KIND



This is the first space that must be conquered

Two thousand years ago Lucret wrote about a trip to the moon. Today, the two thousand years of dreaming he inspired are close to fulfillment.

Experience in building things from dreams has always been part of Ex-Cell-O. Precision in design, precision in manufacture for forty years has been the Ex-Cell-O tradition. Now as we near the conquest of space, even more important becomes speed of translation from dream to reality. And for this Ex-Cell-O's history and facilities are yours for the asking.

EX-CELL-O FOR PRECISION



EX-CELL-O
CORPORATION
DETROIT 26, MICHIGAN

Aircraft
Division

AVIATION CALENDAR

March 27-28—Flight Training Conference, American Rocket Society, DuSable Plaza Hotel, Detroit, Mich., Pa.
March 28-29—National Convention, Institute of Radio Engineers, Columbia and National Aeronautics Building, New York, N.Y.
March 28-29—1966 Aeronautics Conference, Pacific Coast Section of the Society of the Plastics Industry, Hotel del Coronado, San Diego, Calif.
March 31-April 3—National Aeronautics Meeting, Society of Automotive Engineers, Hotel Commodore, New York, N.Y.
April 2-3—Conference on Electronics, Electrical Engineering, sponsored by the Thermal Radiation Laboratory of the Geophysical Research Directorate of the Air Force, Cambridge Research Center, Massachusetts Institute of Technology, Boston, Mass.
April 3-8-1966 Nuclear Congress, Municipal Auditorium, Cleveland, Ohio.
April 6-8-1966 National Military Industrial Conference, Palmer House, Chicago, Ill.
April 8—Aviation Post No. 741 Goes West, Mitchell Hotel, New York, N.Y.
April 12-13—Annual Meeting, American Association of Airport Executives, Savannah, Ga.
April 12-13—International Conference on Structure Mechanics Institute of Technology, Cambridge, Mass., sponsored by Air Force Office of Scientific Research/Grant State Science Division Office of Naval Research, National Science Foundation, National Academy of Sciences/NAS, (Conduct Dr. David K. Fink, National Academy of Sciences, Washington, D.C.)
April 12-13—Las Vegas Area's World Congress of Flight, Las Vegas, Nev.
April 13-17—Second United Symposium on Subsonic and Supersonic Phenomena, San Francisco, California, Calif.
April 18—Conference on Aviation Safety, (Continued on page 6)

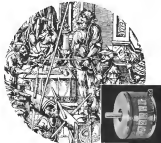
AVIATION WEEK, including Space Technology
March 16, 1967
Vol. 76, No. 11

AVIATION WEEK, including Space Technology, is a comprehensive source of information on the latest developments in the field of aviation. It covers a wide range of topics, from the design and construction of aircraft to the latest advances in propulsion and materials. The publication is essential reading for anyone involved in the aviation industry, whether as a designer, engineer, or manager. It provides a detailed look at the challenges and opportunities facing the industry, and offers insights into the future of flight. The publication is available in both print and electronic formats, making it accessible to a wide range of readers. It is a valuable resource for anyone interested in the world of aviation.

Subscription rates for 1967 are as follows: Single copy, \$5.00; 12 issues, \$50.00. Subscriptions are available in advance only. Payment should be made in U.S. dollars. Subscriptions outside the U.S. should be sent to the nearest American consulate or to the publisher, Aviation Week, 1230 Avenue of the Americas, New York, N.Y. 10020. For more information, write Dept. 247.

AVIATION WEEK, March 26, 1967

FAIRCHILD POTS ARE TORTURE TESTED



ONLY FAIRCHILD TORTURE-TESTS 1 OUT OF EVERY 100 PRODUCTION UNITS

Check these additional Fairchild Reliability Features:

- ✓ **FAIRCHILD** Quality Control also continuously samples production for compliance with engineering specified standards for materials and processes in accordance with MIL-Q-9000C and MIL-STD-200A.
- ✓ **FAIRCHILD** has complete test equipment on the line and each assembler checks his own work—in addition there is an independent 100% sub-assembly and final inspection.
- ✓ **FAIRCHILD** has complete environmental facilities in duplicate for engineering prototype as well as production testing.
- ✓ **FAIRCHILD** development units are tested to simulate environmental exposures before they are released to production.
- ✓ **FAIRCHILD** units plus production to insure performance before full production begins.
- ✓ **FAIRCHILD** pots are type tested to insure performance beyond applicable military and customer specifications.

Only Fairchild Linear and Non-Linear Pots incorporate all of the above Reliability Features. These High Reliability units can be had in 1/2" to 5" diameters, single and multi-turn, in standard and high temp versions and with accuracies as high as .0001%.

For more information write Dept. 247.



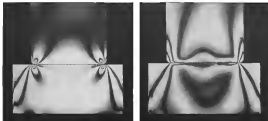
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COMPONENTS DIVISION

225 Park Avenue, New York, N.Y. 10022
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ROLLER BEARING LIFE AND CAPACITY LINKED TO STRESS DISTRIBUTION



These reproductions of photoelastic studies contain important guidance for every engineer and designer concerned with the performance and selection of roller bearings. In these photographs, the otherwise dark and light areas, called fringes, indicate not only the magnitude of stress but also the stress distribution. The photographs were taken by Bower Research Engineers during a study of stress distribution in roller bearings.

The subjects represent rollers and innerways of two roller bearings under identical loads. The distribution of the left shows a roller of conventional design. The illustration at the right shows a Bower "Profiled" roller. That is, the roller is precision ground with a large radius generated along the body of the roller—a predetermined and controlled distance from each end.

The conventional roller photo (left) clearly shows how, under load, stress concentrations build up to and near the

roller ends. This is called edge-loading. Such areas of concentrated stress are the breeding grounds for metal fatigue and eventual bearing failure.

In the photo of the "Profiled" roller (right) stress lines are to be seen uniformly distributed across the whole length of the roller and innerway. There are no points of excessive stress concentration, no overstressing points for early fatigue. Such a "Profiled" roller exhibits a great advantage in improved load-carrying capacity, a most important bearing requirement.

Under actual operating conditions, Bower "Profiled" roller bearings show a considerably longer life at higher

speeds and under greater loads than conventional roller bearings.

Because of this, and of other Bower features to be discussed in later technical reports, we suggest that you consider the advantages of Bower bearings in satisfying your future bearing requirements.

* * * *

Bower engineers are always available, should you desire assistance or advice on bearing problems. Bower produces design aids for tapered roller bearings or journal roller assemblies. Bower makes these aids in a full range of sizes and a set.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION • BROWN ADVANCE ENGINEERING INC., NEWTON 11, MASSACHUSETTS



STEPS IN THE MARCH TO OUTER SPACE

Mars Snoopers

This nuclear-fueled reconnaissance craft is preparing to head on Mars' outermost satellite, Deimos—52,500 miles away from the "Red Planet" (Jupiter) and 35 million miles away from the earth.

Deimos' gravitational pull is so slight that a hitherto-forgotten could be made, and a take-off could be accomplished with little more than a shove of the planet's feet (at Deimos' orbital speed, such a push would start the ship back to Earth at 3500 miles per hour).

Our spaceship is designed to fly in two directions—first as a space rocket

and then first as a bomber airplane. Propulsion for both is provided by a single rocket heat source, reaching with hydrogen for rocket thrust, and with atmospheric to power the wings.

Travel to Mars, involving the landing, take-off and re-entry are accomplished by rocket thrust. As the ship approaches the Earth's atmosphere it assumes a spiral first attitude. The "inertial down" encloses the rocket nozzle and the ship is transformed into a high speed, swept air

plane with M-shaped wings. Control fins are located in the nose of the craft, near the crew's quarters.

Inertial navigation systems will play an increasing role in the exploration of outer space. **ARMAS**—now growing such systems for the Air Force TITAN and ATLAS ICBM's will be in the vanguard of the race to outer space. **ARMAS**—Garden City, New York. A Division of American Bosch Arms Corporation.

AMERICAN BOSCH ARMS CORPORATION

step up your missile program with Solar's proven capabilities

1 Solar's Proven Leadership in Engineering and Research

Since World War II, Solar's versatile engineering and research divisions have made many significant contributions to missile technology. They range from the development of lightweight, heat-resistant all-metal sandwich structures and high-temperature coatings to the solution of difficult manufacturing problems involving missile fuselages, fuel tanks, nose cones, liquid propellant rocket cases and others. Right now, Solar is participating in the design, development and production phases of all of America's major missiles.

Responsibility for Solar's current missile program is centered in a team of experts experienced in the many phases of missile development—from conception to prototype and volume production. Collective experience of Solar's outstanding engineering and scientific team includes work on every major missile program.

2 32 Years Experience in Tuning "Hard-to-Work" Metals

Today, Solar is the only company that has successfully furnace-treated giant rocket engine chambers for all of America's largest missiles. The chambers—designed to withstand combustion temperatures of 3000 F.—are but one example of Solar's proven leadership in high-temperature technology. This leadership, along with the nation's most advanced heat-treating facilities, is an important part of Solar's missile and systems capability.

3 Solar's Diversified Output Strengthens Missile Capability

Solar's many products, while diversified, share a logical common bond. All are precision engineered, all derive the benefits of Solar's extensive research and testing programs, and all are built to withstand stringent service conditions. Major areas of activity include:

AIRCRAFT AND MISSILE SYSTEMS AND COMPONENTS: Missile fuselages, nose cones, thrust chambers, solid propellant rocket cases and nozzles, controls, servos, charburners, and other precision-built components.

CAS TURBINE ENGINES: Lightweight, precision-cast gas turbines ranging from 50 to 1100 hp for aircraft and aircraft ground support, airborne auxiliary power, propulsion and others. Solar has long been a leader in this field.

SYSTEMS SYSTEMS AND EXPANSION JOINTS: Design, testing and production of complete ducting systems for aircraft and missiles. Largest array of expensive joints in the world, precision engineered and manufactured to existing standards for handling of liquid missile fuels and for other applications involving difficult problems of stress, temperature and vibration.

STRUCTURAL COMPONENTS AND SYSTEMS: Design and development—controls, tracking systems, missile instrumentation, data processing and communications systems, acoustic and optical guidance and control systems, target control systems, air-to-air refueling, reconnaissance and timing systems, analog computers and others.

4 Specialized Facilities in San Diego and Des Moines

Solar's large completely staffed and equipped plants in San Diego, California, and Des Moines, Iowa, have the capabilities, experienced personnel and specialized facilities to undertake missile and systems programs of the widest scope and variety. Engineering, research and production facilities are being expanded by construction of one of the largest modernized warehouses at Fairmont in the nation (for heat-treating large missiles) and a new 60,000 sq ft engineering and research building.

For detailed information on how Solar can put its products, services and facilities to work for you, write to Dept. F-124, Solar Aircraft Company, San Diego 12, California.



ENGINEERS WANTED: Challenge your abilities, selected representation with Solar Aircraft Company.

Just give us the "envelope". . . we'll do the rest!



AERONCA'S PACKAGES

ASSURE MAXIMUM RESULTS ON PRIME AND SUB-CONTRACT PROJECTS

* Design Tooling Production

Contemporary weapons systems, because of their complexity, necessitate sub-contracting of major components, sub-systems and structures. And versatile capabilities . . . theoretical, technological, mechanical and managerial . . . are required to produce these "envelopes" efficiently and economically.

Aeronca has these integrated facilities. That is why we can provide a Co-ordinated Design, Tooling and Production Service. This packaged service begins with evaluation of basic environmental data and collaboration with "on schedule" deliveries. It has been eminently successful in supporting current operational weapons systems.

Aeronca's leadership is evident in its existing facility for designing and producing . . . in quantity . . . a complete range of heated stainless honeycomb structures. This specialized capacity is one of the few in actual operation in the industry today.

With extensive background in proprietary and sub-contract programs, Aeronca is prepared to work with you on air vehicle, missile, ground support equipment and technical consultation projects. And we can say with confidence . . . just give us the envelope and we'll do the rest.



AERONCA manufacturing corporation

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MIDDLETOWN, OHIO

Wide Bandwidth with True Differential Input

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Instrumentation
Amplifiers give you
all these features...

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at gain of 100
- **TRUE DIFFERENTIAL INPUT**... true
balance, low capacity
- **HIGH COMMON MODE REJECTION**...
200,000 to 1 dc... 50,000 to 1 ac
- **HIGH GAIN**... selectable gains of
100, 200, 500, 1000, 5000
- **HIGH STABILITY**... drift less than
2 μ v per day, less than 5 μ v long term
cumulative drift
- **LOW NOISE**... less than 3 μ v rms to
50 cps
- **HIGH POWER OUTPUT**... \pm 20 volts,
up to 60 ma
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- **FAST RISE TIME**... 1.2 μ sec for full
scale step input at gain of 100
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of twice nominal output
- **NO REQUIREMENTS ON CALIBRATION**
- **NO BATTERIES**



With the ever-increasing need for greater accuracy in dynamic instrumentation the demand for an expanding bandwidth in signal amplification becomes more and more urgent. Epsco Instrumentation Amplifiers not only meet the bandwidth challenge, but they also provide true differential input.

Available rack mounted or as portable units. Write for Bulletin 10080 for complete technical information and prices available.

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First in data control

Epsco, Inc., Instrument & Equipment Division, 235 Commonwealth Avenue, Boston 15, Massachusetts

An Announcement Military Products Division of AMERICAN-Standard

The new Military Products Division — with a background of twelve years experience as an integrated organization — will carry on and expand the work it formerly handled as a department of the Detroit Controls Division of American-Standard.*

The Military Products Division consists of three departments:

The Systems Department —
navigation systems,
ambulance systems, and
related military equipment

The Components Department —
gyroscopes, accelerometers,
and auxiliary controls of
exceptional reliability

**The Control Manufacturing
Department** — precision
control production

American-Standard, Military Products
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AMERICAN-Standard
MILITARY PRODUCTS DIVISION



New steels are
born at
Armco

ARMCO 17-4 PH 17-7 PH STAINLESS STEELS

Specified in America's Space-Shrinking Jet Airliners

In all of the new swift and sturdy commercial jet airliners, Armco's Precipitation Hardening Stainless Steels are used to help achieve dependable rugged strength and economical performance (saving lightness).

Both of these special Armco Steels, developed specifically for the aeronautical industry, offer a unique combination of high strength weight ratios at temperatures to 900 F., good corrosion resistance, and fabricating characteristics that assure productivity.

Their specification for components such as forgings, rod and pin structures, thrust reversers, engine parts and accessories by manufacturers with available quotations is evidence of their effectiveness and economy.

Because of their unusual combination of properties and fabricating characteristics, Armco 17-4 PH and 17-7 PH are also widely used in all types of military aircraft as well as short and long range models of all types. These space age metals, plus Armco's newest precipitation hardening stainless, PH 15-7 Mo, offer you the possibility of new and effective solutions in your design and production problems.

For complete information on Armco's Precipitation Hardening Stainless Steels, other special stainless grades and all the structural types, write to Armco Steel Corporation, 1639 Curtis Street, Middletown, Ohio, or fill out and send the coupon.

ARMCO STEEL CORPORATION

1639 Curtis Street, Middletown, Ohio

Send me design and fabricating information on the following Armco Stainless Steels:

- | | |
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| <input type="checkbox"/> Armco 17-4 PH | <input type="checkbox"/> Armco Mod. 12 Chromium Grades |
| <input type="checkbox"/> Armco 17-7 PH | <input type="checkbox"/> Armco 15-7 Mo |
| <input type="checkbox"/> Armco PH 15-7 Mo | <input type="checkbox"/> Armco Standard Grades |
| <input type="checkbox"/> Armco Ferritic-Free Type 430 | |

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LOCKHEED ELECTRA

54 LOCKHEED ELECTRA,
RIVET TOOL
ASSEMBLING TOOLING WITH
BUILT-IN STORAGE

ELECTRA AND HI-LOKS EMPHASIZE DESIGN SIMPLICITY

The Electra, fastest prop jet ever built for commercial service, emphasizes design simplicity to obtain weight and manufacturing economies. In keeping with this design premise, the new Hi-Lok fastener is used extensively in the wing and fuselage.

Basic fastener reliability stems from the consistent design period maintained in each installed Hi-Lok fastener. The automatic torque-off of the wrenching end of the collar during installation to obtain the pretension, also contributes to substantial weight savings in the installed Hi-Lok.

Installation, tooling, and driving techniques are simplified in the Lockheed shop because Hi-Loks are installed

quickly and easily with standard high speed air driven tools using an automatic collar loading technique. Hi-Loks are installed up to 45 per minute.

Design with the Electra "tool" wing is the standard Hi-Lok used as a locking fastener, eliminating need for Orings and other conventional fastener sealing methods.

Today, standard Hi-Loks are available in a variety of high strength and temperature resistant materials for use in aircraft, missiles and ground support equipment.

TRADEMARK ELECTRA, E. & H. AND FREEDOM
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TUBE DISTRIBUTORS BALANCED SERVICE

can improve your steel tubing profit picture!

Important! Of course, if you buy steel tubing regularly, you can improve profits by ensuring production costs, handling and shipping costs, maximum jobs security, smoothest... ordering process, a premium when you buy in warehouse quantities.

1. Personalized Inventory Plan custom-tailored to your requirements
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PERSONALIZED FASTEST PLAN CUSTOM TAILOR TO YOUR REQUIREMENTS. A reserve of tubing is held in your name... at no additional cost. TD inventory is, handling and shipping it, according to your scheduled requirements—as a customer service. You avoid no money, take no risk, and pay nothing extra for this exclusive service.

Call TD for—selection, order and on-line steel tubing, both in stock and commercial quality.

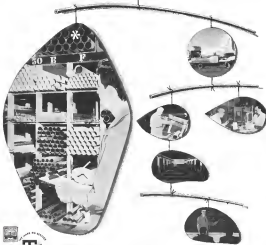
Write Dept. W-10 today for your copy of "Eighteen Ways to Save Money on Your Steel Tubing Purchases," and the name of your nearest TD representative.



Contact your Engineering Standards Group for complete data on the new Hi-Lok fastener... all within its use.



hi-shear RIVET TOOL COMPANY
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NAVY SELECTS RYAN C-W DOPPLER NAVIGATORS FOR MAJOR AIRCRAFT

Seventeen types of Navy aircraft will be equipped with Ryan continuous-wave Doppler navigation systems, the AN/APN-122 (N), under an initial \$10-million contract awarded by the Navy to Ryan's Electronics Division. Ryan's automatic, all-weather, self-contained navigators will be installed in the Navy's Lockheed Kingfisher (P-3), Martin Marlin patrol planes (P-3M), carrier-based Douglas Sky Warriors (A-1J), and three types of Grumman aircraft.

Developed in cooperation with the Navy, these advanced electronic systems are the lightest, sim-

plest, most compact, and most reliable of their type. The new units, one of the largest of its kind, comprise Ryan's leadership in navigation and guidance systems.

With a total backlog of ten and other important contracts for RYANAV systems, the Ryan Electronics Division is growing even faster than this fastest growing industry. Personnel and facilities are being doubled, both in the new production plant at Torrance, Calif. and at the San Diego facility, where a modern new electronics research center is under construction.



The electronics production facility at Torrance (left) and Angeles



New electronics research center at San Diego

Ryan's rapid growth in electronics is creating new opportunities for engineers and technicians.

RYAN BUILDS BETTER

—ELECTRONICS DIVISION—

Ryan Aeronautical Company, San Diego, California

Aviation Week

Exclusive Space Technology

March 16, 1959

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First NASA Scout Space Vehicle Due by Aug. 15 26

Boys for surface contract will be submitted this week in push to develop space research project

Latin Rate War Hears Showdown Stage 38

Predicted settlement of force cutting dispute not expected to trim foreign-carrier competition

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Sandwich construction also contributes to surface stability and smoothness of handling Pope bomber's crooked crescent wing

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73,707 copies of the issue printed

Navy's Anti-Submarine Warfare Problem

The problem of developing an efficient anti-submarine warfare capability against nuclear powered submarines is probably the Navy's top priority problem for the future. In addition to its anti-submarine capability, the nuclear powered submarine also offers a strategic threat when equipped for nuclear missile launching.

The Soviet Union is developing a strong submarine warfare capability both in its peripheral waters and for long range transoceanic strategic operations. It now has an operational force of some 450 submarines, of which about half are long-range modeling types. This fleet is already larger than the most powerful submarine force Nazi Germany was able to launch at the peak of its terribly effective campaign against allied shipping in World War II. Soviet submarines have become increasingly active, well within their international rights, in the Atlantic where U.S. Navy ASW forces have concentrated and tested their underwater, substantially not long enough to force them to surface. The Soviets announced last December an extensive program of undersea scientific exploration, including exploration of the North American Continental Shelf.

Increasing Soviet Capability

There also is evidence that the Soviets are developing nuclear powered submarine capability. The three small nuclear reactors now being tested aboard the schooner Lomonosov are all types designed for eventual use in sub reactors, and submarine hulls designed for nuclear power are now under construction in Russia. Rear Adm. John S. Thach, commander of Task Force ALFA and one of the top U.S. Navy ASW experts, believes the recent reduction of the active Soviet submarine fleet strength from 664 last June to the present 450 is an indication that crews are being withdrawn from operational status for training in the techniques of nuclear submarines.

ASW is hard, dirty and unpleasant work and has never been a favorite career among top Navy officers. Until recently, it has been just as difficult to staff the positions of ASW within the Navy as it has been to the Defense Department and the Congress. However, in recent years, thanks to the evangelism of some devoted ASW advocates, the Navy has developed a growing capability in the field within the technical and logistical resources available to it. Development of submersible small and air transportable nuclear depth charges has raised the kill probability, once a submarine has been definitely located, close to 100%.

Bottling Obsolescence

However, the big deficiencies in current ASW technique are better detection and communication tools, weapons, coupled with bigger and swifter search forces.

The Navy also has developed a sound weapon system concept for ASW that utilizes every sensor available, locates other submarines through passive craft to airborne equipment. A good example of how combinations of

equipment can stretch the capability of old standby just a little further are the current experiments with down helicopters operated from a destroyer to extend the latter's listening radius.

But all of this is solving old shoes, even with some shiny new technical patches, is only an interim, make shift solution to the Navy's real ASW problem of the future. What is really needed is some basic research and development breakthroughs all along the ASW line, with the possible exception of "last" weapons where a long term solution apparently is already in hand. This research and development effort must range all the way from basic exploration of the ocean floor and the world below the water's surface to new methods of communication and through air and water and combinations thereof, new methods of long range detection down to depths far below present capabilities and through new vehicles for surface, surface and underwater search efforts.

While current ASW capability must be developed and stretched to its inherent limits, the real ASW problem now lies in the research and development area. Therefore, it is particularly depressing to note the shockingly small funds being allocated to the Navy's ASW Research and development effort in both the current Fiscal 1979 and the future Fiscal 1980 budget. This sum is now coming along under a somewhat arcane budget ceiling for Fiscal 1979 despite a \$48 million request by Congress above Administration requests. Prospects are that ASW research and development will take a slight cut in the Fiscal 1980 defense budget now being debated on Capitol Hill. We urgently recommend that Congress take a long and detailed look at this particular area where a common sense as to which the present submitted budget is seriously deficient.

Aid From Industry

In face of this official budgetary indifference, it is encouraging to note the response of the private industry and its related technologies to the Navy's plan for a broad attack along the research and development frontiers of ASW. Within the past few, several major firms have created ASW research and development organizations within their own industrial structure to give the services approach to this problem. Because of the priority of Navy funds for this work, many other firms are looking for funding and development programs on their "dollar a year" Navy contracts. The active response of industry to the Navy's needs in this area has been a marked contrast to the relative indifference of the highest official levels.

We fervently hope that industry will continue this long term involvement in the ASW problem and that the commander within the Navy who has been fighting to lead in this critical spotlight on the problem will not be dissuaded by top-level official criticism or indifference, and that the Congress will devote considerable attention to this important facet of our overall defense structure.

—Robert Hoot



New Gilfillan electronic brain insures air safety!

Latest product of Gilfillan creativity is an electronic brain, an automatic ATCA. It measures, in three dimensions, the exact position of an approaching aircraft in relation to the final approach to the runway. The Gilfillan electronic brain then estimates a "word phrase" storage drum, which sends standard voice commands to the pilot so that he may keep his aircraft on the ideal glide path and approach course. This result is greatly improved safety, accuracy and cost economy of the aircraft's final approach.

The operator's function in this new flight safety development by Gilfillan is that of a monitor. Automatic voice is adaptable to any language and no additional equipment is needed in aircraft.

Gilfillan's 45 years of experience coupled with creative capabilities in the fields of Air Navigation, Electronic Communications, Missile Systems and Instruments, Radar Transmitters and Ground Support Equipment, are available for complete research, development and production in these fields.

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THOMAS A.

EDISON

launch range computer
calculates distance
from aircraft to target—
automatically



Edison launch range computer (shown here) is used to compute, in milliseconds, distance from aircraft to target. It is used to compute, in milliseconds, distance from aircraft to target.



Edison computer contains two control units, control unit, launch range computer, gun train with sight and range, and launch range computer unit. It is a compact package weighing only 40 pounds.

New Edison range computer is a tactical instrument used to compute distance from aircraft to target. It is used to compute, in milliseconds, distance from aircraft to target. It is used to compute, in milliseconds, distance from aircraft to target.

This range computer is another example of Edison's capability in research, design and production.

Thomas A. Edison Industries INSTRUMENT DIVISION

49 LAUREL AVENUE, WEST ORANGE, N. J.

EDISON ENGINEERING OFFICES ARE LOCATED IN BOSTON-BALTIMORE-CINCINNATI-DALLAS-DETROIT-LOS ANGELES

WHO'S WHERE

In the Front Office

Lee S. Johnson and Paul E. Smith, directors, The Balluff Co., Balluff Corp., New York, N.Y. Mr. Johnson is vice president of United Aircraft Corp. and general manager of Balluff Aircraft Division. Mr. Smith is The Balluff Co.'s treasurer.

Edward E. Fisher and A. P. Fournier, directors, Balluff Aircraft Corp., New York, N.Y. Mr. Fisher is vice president and general manager of Balluff Aircraft Division. Mr. Fournier is engineering vice president of the company.

Ralph A. Blau, Jr., director (Aircraft Division), Balluff Aircraft Corp., New York, N.Y. Mr. Blau is vice president and general manager of Balluff Aircraft Division.

W. H. Scheraga and Don L. Walker, Jr., directors, Balluff Aircraft Corp., New York, N.Y. Mr. Scheraga is vice president and general manager of Balluff Aircraft Division. Mr. Walker is vice president and general manager of Balluff Aircraft Division.

Richard E. Brown, consulting engineer and director, Specialized Engineering Services, Inc., North Hollywood, Calif. Mr. Brown is a member of Space Technology Laboratories, Inc.

Camelback Electronics Corp. has announced that the Systems Division is now Camelback Systems Corp., Mountain View, Calif., operating as a subsidiary of CRL.

Philip S. Fong, CRL president and local chairman, and Kenneth W. Pataki, CRL vice president and local chairman and president, respectively, of the new company.

Harry E. Burke, Jr., has been named vice president and general manager of the new company. Other officers are: Franklin H. Bennett, financial vice president; Victor J. Pataki, secretary; William E. Fong, treasurer and assistant secretary; John J. McDonald, director of engineering; and John G. Cook, director of manufacturing.

John T. Jenkins, vice president, later retired, Telephonics and Telegraph Corp., New York, N.Y.

R. W. Shattuck, vice president, general operations, Capital Airlines Inc.

John J. Carpenter, vice president, Balluff Aircraft and Development Laboratories, Inc., a subsidiary of Balluff Aircraft Corp., Westfield, N.Y.

W. Gilbert Myers, executive vice president, Lockheed Aircraft Corp., Los Angeles, Calif.

George S. Shaw, chief executive officer, Balluff Aircraft, Inc., New York, N.Y.

F. Ramsey, vice president, Balluff Aircraft, Inc., New York, N.Y.

Robert L. Ball, Jr., vice president, General Aircraft Co., Wichita, Kan. Mr. Ball is based in general manager of General Aircraft Co.'s new aircraft division.

John A. Maxwell, Jr., vice president and general manager of General Aircraft Co., Los Angeles, Calif.

John A. Maxwell, Jr., vice president and general manager of General Aircraft Co., Los Angeles, Calif.

John A. Maxwell, Jr., vice president and general manager of General Aircraft Co., Los Angeles, Calif.

INDUSTRY OBSERVER

Boeing has developed the solid-propellant approach to a booster for its entry in the Dyna-Solar orbital bomber competition and is expected to test with General Dynamics. Boeing probably would use a modified Atlas plus the General Dynamics Booster. General Dynamics Booster is a two-stage solid-propellant engine as a launching vehicle. General Dynamics Booster is a two-stage solid-propellant engine as a launching vehicle. General Dynamics Booster is a two-stage solid-propellant engine as a launching vehicle.

Marine Ball Dyna-Solar concept now calls for a four-segment Atlas as the booster vehicle rather than the Atlas as the Atlas plus high-energy solid stage as originally planned.

Avco assembled a total of \$18.5 million in its share in the Aero-transportable anti-ballistic missile system recently awarded by the Defense Department (AW Feb. 14 p. 12). Program began by Avco as a defense contract for the first time, was taken over last year by the Advanced Research Projects Agency.

McDonnell Aircraft Corp.'s two-stage test vehicle for an air-launched ballistic missile has eight times rapidly speed around the circumference of the body. Body half is approximately 20 ft long. Four feet are spaced 90 deg. apart in the first stage. Four feet are spaced 90 deg. apart in the second stage but after four feet in the first stage the 45 deg. Vehicle was recently ground-launched over the Atlantic Missile Range (AW Mar. 2 p. 21).

ARGO D-4 four-stage research sounding rocket using Boost Jet as a booster, two Nike Ajax motors in tandem in its first stage rocket developed by Mrs. Bernice de Chasse and Algonquin Ballistic Laboratory, will be fired within the next future by Aerojet Development Co., Azusa, Calif., under military contract. Three vehicles are now being built, each will carry a 60 lb payload to a 1,000-m altitude.

North American F-100 Super Sabre in service with Tactical Air Command will get a 700-psi boost in a modification program now in progress at North American's Los Angeles Division. F-100s will be equipped with two 450 gal external tanks suitable for aerial refueling from either regular TAC tankers or other Super Sabres using the "buddy" system. Prior to the modification program, only the 1,155 gal capacity of the F-100 internal tank could be refilled by aerial refueling.

Passive communications satellite to be launched next year by National Aeronautics and Space Administration will be put into a 1,000 mi orbit, giving it a period of about 110 min. The 67-lb, 310-ft-diameter satellite will be placed in orbit with a transmitter, with receiver (ground equipment) on orbit of a high-gain antenna, low-noise receiver, large flexible dish-shaped antenna and computing equipment.

First flight for the Saturn I 5 million lb thrust cluster of Rocketdyne engines is now scheduled for September of next year. Booster is being developed by Aerojet Ballistic Missile Agency. Preliminary engine test firing is hoped for before the end of this year.

Army Martin-Pedding selective range missile, the solid-fueled replacement for Redstone, was allocated \$500 million for development during the current fiscal year. Program was initiated in June 1955 with an allocation of \$20 million.

Naval will make a major, possibly last-ditch, effort to win approval of its proposal to purchase three British Pegasus flying boats for patrol missions to receive gunships during the forthcoming hearings on the U.S. ANP program by the Joint Congressional Committee on Atomic Energy. Pegasus, originally ordered by the Administration, involves a total cost of approximately \$100 million, would have all three aircraft converted and flying in mid-1956 within five years.

LINDE's NEW PLASMAC ARC SERVICE

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New method of fabricating refractory metals can make this . . . The high melting points of tungsten, tantalum, and molybdenum are no longer a problem. For LINDE's new PLASMAC ARC Torch, working in the temperature range between 15,000 and 30,000 degrees K, can melt parts or form shapes of virtually any size or complexity. It's an entirely new way to make such articles as rocket nozzles, crucibles, components for electronic X-ray use, and parts for atomic energy equipment!

The quality of these pieces is uniformly high. Tolerances can be held to $\pm .002$ in. or better. The metal

loses none of its purity and superior density is achieved.

With the PLASMAC Torch, LINDE is equipped to supply you with parts made of, or coated with, refractory metals or made of a variety of metals combined with non-metals or reinforced plastics. LINDE will also provide a wide range of materials testing service based on this device. For information on the extensive of LINDE's well-known Flame-Fixing service, write Dept. AW-13, LINDE CARBIDE, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. In Canada: Union Carbide Corp., Division of Union Carbide Canada Limited.



The PLASMAC Torch employs a non-membraned electric arc to generate such high temperatures that particles are solidified into the chamber is heavily melted. From quartz flowing continuously during the work process to a plastic resin and diamond film on the workpiece at microscopic levels, less of CO₂ and the particles usually to form back and re-solidify instead. Crystals—very as graphite—have an excellent bond. Shapes are built up on mechanical workpieces, which are then melted away to form parts such as those shown above.

"Linde," "Union Carbide" and "Plasmac" are trademarks of Union Carbide Corporation.

Washington Roundup

President Views Defense

President Eisenhower said last week that if Congress persists in trying to make the Defense Department keep Army and Marine Corps expenditures higher than the Administration desires, "I'll have to put these people . . . put some place where it's nice to keep them out of the way, because I don't know what else to do with them."

"The President had been asked at the press conference what he felt 'the right to throw the will of Congress' in cutting Army and the Marine Corps' strength or refusing to spend money given him for weapons, etc. He said he thinks 'Congress is sometimes mistaken, as I think, in the past they have made some very bad mistakes in dealing with defense. All right. I'm to correct them.'"

Another reporter mentioned the charge that the Administration puts a balanced budget ahead of national security and asked if the President would spend more on the armed forces if he could look forward to a surplus in the treasury.

The President said he would not. "I'm just tired even of talking about the idea of a balanced budget against national security," he said. "That's not a very nice thing, and it's not a very nice thing that a balanced budget in the long run is a vital part of national security."

"Why doesn't someone have the courage to get right up and say, 'I want \$5,000 more,' and make this war these countries because they'll be stretched at some convenient place and we don't like it, but we need the arms for it?"

Rep. John McCawhill (D-Mass.) House majority leader, recently urged the President to call for higher taxes if this is necessary to finance greater defense spending within a balanced budget (AW Feb. 16, p. 25). And following the Eisenhower statement, Sen. Stuart Symington (D-Mo.) echoed McCawhill's earlier remarks, adding if higher taxes are needed to support an adequate defense program "we certainly ought to have them."

Pluto Slowdown

Major slowdown in the Pluto nuclear reactor project (AW Oct. 25, p. 33) also is being forced by Budget Bureau. Atomic Energy Commission's report of \$16 million construction funds for Pluto 1965 was cut to \$2 million. In addition, Budget Bureau withdrew all Fiscal 1959 construction funds for six months, did not release them for commitment until January. Members of the Joint Congressional Atomic Energy Committee, after conducting hearing sessions, are scheduled to report on two other advanced AEC projects—Reactor nuclear reactor project, and the Super power to develop several small auxiliary nuclear powerplants.

McElroy's Departure Schedule

In another note, Defense Secretary Neil McElroy hopes to leave government service before the end of the year to become chairman of the board of Procter and Gamble Co. which he had served as president before coming to Washington. Eisenhower agrees with it, a large task option plan. At a recent press conference, McElroy said:

"I am staying on in this assignment, as I announced when I came in, at the pleasure of the President. There

are, as the President himself, certain personal factors in my life which either suggest push me toward a departure before the conclusion of this Administration's term of office. I don't expect to have that suggest question come before me before the end of the year. I expect to stay throughout this course of the Congress. I expect to be here in the setting up of the principles of the 1961 appropriations budget."

Schriever, ARDC Head?

Also worth for Maj. Gen. Bernard Schriever, now head of USAF's Ballistic Missile Division, to be named commander of the Air Research and Development Command, replacing Lt. Gen. Samuel Anderson, who formally left the post on Nov. 10 to become commander of the Air Materiel Command.

Judgeship for Durfee?

On the civil side of the Administration, one of two top candidates for appointment to the judgeship of the Federal Court of Claims is chairman of the Civil Air Transport Board, James Durfee. If Durfee wins and accepts the post, which observers here say is aNR, chances are strong that the Federal Aviation Agency will have a major voice in the presidential nomination of Durfee's successor in order to ensure close cooperation between the Board and the civil agency. Another Board member will open the end of this year when Howard D. Demery's term as a Board member expires.

CAB Probe of ATA

Aud. Civil Aeronautics Board last week began a full-scale inspection and review of the Air Transport Association, the first since 1948 when ATA's articles of association were first approved by the Board. Of particular interest to the Board will be an investigation of the financial position of this is such as accounts and contributions by the association's members. The Board also expressed its interest in the inspection that it wants "to determine to what extent, if any, the large carrier control the operations of the industry through the membership of the ATA." In its review, the Board will look into "sources, amounts and spreads of all meetings of members, committees, board of directors' conferences and association boards' and all other accounts and records."

IDA Personnel

In Congress, the House Military Operations Subcommittee is focusing on industry connections of the personnel employed in the Institute of Defense Analysis. IDA was organized with a \$500,000 grant from Ford Foundation to supply the personnel for cultural collection studies for Department of Defense. Garrison Newton, former Assistant Secretary of Navy, is president; Albert G. Hall, former physics professor of Massachusetts Institute of Technology, is vice president. Both are IDA board members; from universities and industry for Defense Department studies, but 10 percent of personnel are already employed by IDA. Hall told the subcommittee that the panelists that personnel can do temporary service with IDA to obtain inside defense information of high value to military as "a very great concern."

—Washington staff



Over-Temperature Indication Cuts X-15 Flight Check

North American Aviation's X-15 research vehicle was canceled about 70 min. last week for the first time, along under the right wing of a Boeing B-52, but first engine flight was not short at that point when an over-temperature indication was registered in the rocket-powered aircraft. Over-temperature problem was possibly connected with a supply of hydrogen peroxide misapportioned stored aboard the X-15 since it is required in operation at all of the jet reaction control system. Some over-temperature was observed. With NASA test pilot Scott Crossfield piloting the X-15's, vehicle stability augmentation and communication systems was checked during the flight, which reached an altitude of 35,000 ft, and a speed of Mach 0.81. Boeing B-52 mother ship was piloted by Capt. Charles C. Bolt, Jr., and three chase planes accompanied it. North American plans to make about 20 flights in its structured engine system proving program on the first X-15. Prover flights are expected to be made on the second two X-15 vehicles, since a large amount of B-52-X-15 compatibility work clearly will have been accomplished, plus a certain amount of structural and systems proof work.

the possible financial risks inherent in testing active guidance now.

Gen. Taylor and funds for Army aircraft now make program fall substantially short of those needed to work the goals recommended by the Joint Chiefs of Staff and which he feels are required for the mid-1970s before in case with the high and low altitude thrust of the various booster and the air-to-airer missile.

Gen. White told the subcommittee that, while certain scientific reasons do cut off the U.S. is ready to begin development of a rocket-powered aircraft, he considers the program still early advanced that construction of a prototype aircraft could proceed and the population phase of the program accelerated.

Later, Rep. Melvin Price (D-Ill.), chairman of the Joint Congressional Atomic Energy subcommittee on research and technological projects to Gen. White's statement as "farther evidence" of the importance attached to military experts to accelerating the aircraft research program.

"It is clear," Price said, "that Gen.

White and his expert military advisors believe strongly... that the program is sufficiently advanced technically to warrant the commencement of work on an interim and propulsion system suitable for first flight."

In another area, he said, the revenue that will result from the Atomic Energy program proposed by the budget is substantially less than what the Air Force actually submitted.

Gen. White said the Air Force sub-

Hawk Cut

Washington-Army defense test work that is Raytheon Hawk by-vehicle defense missile will not be deployed at first (introduction in the U.S. and that it has formally declined plans to take part in the Navy-developed Hawk defense missile air program because it would not affect it. Army had planned to couple the Hawk with the high-altitude Nike Zeus for air defense defense. The project, however, was rejected by the Joint Chiefs of Staff. Hawk may still be used by NATO nations.

tion construction program is assigned in terms of support-type facilities and does not provide for the cumulative and growing deficit in total capital equipment. Also, he said, the Fiscal 1966 Air Force operations and maintenance funding is minimal and will require deferral of certain programs which would be desirable and, in some cases more economical, to accomplish with Fiscal 1966 funds.

In order to maintain Navy capabilities, Air Force and more funds should have been provided for maintenance and modernization of ships and aircraft, procurement of new ships, air craft, guided missiles and their associated electronic equipment, acquisition of anti-submarine warfare program, procurement of first ballistic missile defense systems and increased research and development effort.

Gen. Felt told the subcommittee he felt the Missile Corps requires personnel to adequately train three divisions and three missile wings and therefore allocated strength at 180,000. The budget provides for only 171,000.

Boeing 707 Development Writeoffs Shave \$9 Million From Earnings

New York-Huay developmental writeoffs for its 707 jet transport played a major part in dropping about \$9 million from Boeing Airplane Co.'s earnings last year and the outlook is for another substantial drop in earnings this year.

Latter earnings after the year also will be a factor, the company reported. Members of the B-322 bomber and B-52C tri-jet aircraft models from cost reimbursement type contracts to final contract bids will bring earnings on these programs to low levels in the first half of 1959.

Boeing's 1958 sales of \$1,711,629,375 were an all-time high for the company—the previous record was \$1,196,383,519 in 1957—yet the company's net income of \$1,196,383,519 was a low level for the company's earnings of \$1,196,383,519.

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A calculated loss at Boeing increased on 707's delivery as an order book in the current order book. But the company expects an aggressive sales campaign to turn the program into a winning one over the period of years.

Writeoff for 707 research, develop-

ment, administrative and other costs expenses were approximately \$14 million in 1958. In addition, there was charged against earnings a \$26 million net loss which "represents the amount necessary to reduce accumulated charges (loss) in progress at Dec. 31, 1958, on the 707 program to a current program level." The company said that it expects to reduce the amount of charges to a level of \$14 million in 1959.

Total charges, including the prototype charge, have amounted to \$4 million since the program's inception in 1952. The Los Angeles Regional Research Council Board has recommended that Boeing make a \$6 million refund for 1958, but a decision for it, for 1958, has been made and will be made in 1959. The Los Angeles Regional Research Council Board has recommended that Boeing make a \$6 million refund for 1958, but a decision for it, for 1958, has been made and will be made in 1959.

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Writeoff for 707 research, develop-

Discoverer 1 Orbit

Los Angeles-Discoverer 1, a probe orbit satellite first from Vandenberg AFB, has been reported to have been sighted visually from Air Force installations in the vicinity of Fort Belvoir, Alaska, only last week, although official confirmation was not available.

Previous flight of 41 tracking reports have been received by additional radio contacts including signals received by General Electric's Alaska station which was the Kona method based on a series of Kona in motion tracking of the satellite in a series through space. Signals from the satellite's radio beacon were still sparse, indicating that the complete orbiting around states was still pending.

Short range figures indicate the orbiting period of Discoverer 1 is 93.649 min. per orbit (75 sec. and approx. 570 mi.). Rate of the satellite is expected to extend beyond 30 days from launch date.

No line tracks (radio signals) have been received. Visual sightings, orbiting around states would present a 19th long target for a radio beam. From the orbit, the satellite would only offer a 90 degree horizon, making radio contact difficult.

211 circuits of the earth and had been interrogated successfully. 152 times by ground stations. On 19 orbits, it did not pass within range of an interrogation station. Results showed 152 orbits of data and transmitted in 60 sec. hours. NASA said the thermal design of the satellite was proved when internal temperature measured within one degree of the 110°F design temperature in a static condition (65°F at its time in orbit).

Recked orbit figures for Vanguard II as of Feb. 14 are:
• Apogee—7,085 mi.; perigee velocity—15,250 mi./hr.
• Perigee—146.9 mi.; perigee velocity—18,117 mph.
• Orbital period—156.61 min.
• Inclination to equator—32.509 deg.

Civil Jetstar Order

Lockheed Aircraft Corp. will deliver the first corporate Jetstar airplane to Continental Can Co. by Dec. 30, 1960. Approximately 10 passenger seats are held by Lockheed and the company is negotiating an contract working, delivery dates, terms of payment and special equipment. Corporate versions may be ordered with either four or six engines, depending on customer preference. Prototypes are being built by Lockheed's Lockheed Corp. For regular versions will use PW 6 JT12.

United Aircraft Earnings

United Aircraft Corp. last week reported sales and earnings in 1958 were record since 1947's record company high. Company reported development, production of wide products and United's new division to reduce its technical equipment replaced after decline there was the company and sales were \$1,280,427,887 compared with \$1,282,519,315 in 1957. Earnings declined from \$11,366,736 in 1957 to \$12,284,738. United's operating expenses are known to decline next year, but commercial expense declines will not cut the total will not be much smaller than 1958, the company said. Heavy development cuts in the space and missile field will continue, and may affect 1959 earnings at no government expense is estimated for period.

Scaling of the end of 1958 was \$1,408 million compared with \$1,475 million a year earlier.

Scaling of the end of 1958 was \$1,408 million compared with \$1,475 million a year earlier.

Vanguard Wobbling Hampers Data Return

Washington-Wobbling of the Vanguard II cloud more serious than it seems to be, according to calculations of the data "unreliable" difficulty. National Aeronautics and Space Administration and last week.

Cloud was to stabilize the global satellite around the longitudinal line of the cylindrical contractor peak, inside the shell in giving the whole attitude a final spin rate of 30 rpm. Spin period is about 15 sec., meaning the long rotation can be visible line as much as 20 to 45 degrees.

But Army Signal Corps engineers expect to be able to produce a relatively picture of a part of the satellite's cloud cover from the quadrilateral field of light signals broadcast during Vanguard's 15 days of radio transmission. From launch on Feb. 17 until the batteries expired at 9:17 p.m. EST on Mar. 11—about four days after they were expected to die—Vanguard II had made

NASA Reports Data On Pioneer IV Orbit

Washington—More precise figures for the Pioneer IV lunar probe's location and solar orbit (AVW Mar. 9, p. 121) were reported last week by National Aeronautics and Space Administration's Jet Propulsion Laboratory. New figures are:

- Perisel—294.77 days
- Average speed in orbit—64,385 mph
- Perihelion—91.7 million mi., to be reached at 9 p.m. EST on Mar. 17, with a speed of 68,930 mph
- Aphelion—195.1 million mi., to be reached at 6 a.m. EST on Oct. 1, with a speed of 60,000 mph
- Closest approach to moon—73,300 mi., passing 7.2 deg ahead and 1.7 deg north of the moon, at a speed of 6,490 mph. Dearest closest approach was 70,000 mi. At closest pass, probe was 214,800 mi. from the earth
- Tracking—Probe was tracked for 82

hr, and four orbits after launch in its distance from earth of 307,000 mi. Last signal acquisition was at 10:24 a.m. EST on Mar. 6 in the 59-ft. Goldstone antenna. Probe's 18 extended receiver antennas also had proved that transmitter for four hours on the ground before launch.

- Launching—Probe in trajectory included within 0.5 deg in elevation and plus 1.3 deg in azimuth. Moreover velocity was 26,759 mph, or 130 mph below the desired velocity
- Next approach to earth—July 19, 1972, at a distance of something near 70 million mi.
- Radio navigation—Granger Mueller notes indicated nothing unexpected at the rate of high-velocity motion. Phase angle did not work because moon's range at 73,300 mi. was not large enough to activate it. Despite calculations did work. Dearest temperature rose to 30°C at injection and to almost three
- According note—2 a.m. EST on

Mar. 12, 1971, of which was the Pioneer IV's orbit will have an inclination to the ecliptic of 0.127.

New figures also have become available on Soviet Russia's Molniya satellite (AVW Mar. 11, p. 26).

- Perihelion—51.1 million mi. on Jan. 12, 1971
- Aphelion—140 million mi. on Aug. 21, 1971
- Period—433 days
- Average speed in orbit—61,100 mph
- Tracking—61 hr to a distance from earth of 518,000 mi.

Radiation Belt Data Reviewed by Soviets

Moscow—Radiation belts around the earth are less intense than originally believed, according to data received from the Soviet Luna cosmic rocket and reported in *Pravda*.

S. Vinok, corresponding member of the USSR Academy of Sciences, and his laboratory colleagues, A. Chudakov, and in an article that the data indicates that manned space vehicles will require relatively less shielding from X-rays than those had been expected. The article said:

- Large number of electrons are ticking the earth at altitudes of up to 11,000 mi., but their energy is relatively small, ranging from 10,000 to 100,000 electron volts
- Cosmic radiation intensity at great distances from the earth is negligible, with only two periods passing through the space containing even second. At distances beyond approximately 35,000 mi., the intensity does not change
- Data posed experimentally that the time taken moving around the earth seven in orbit, making, making, for a very long time while located in a magnetic trap created near the earth by the earth's magnetic field. These phenomena are similar to what often takes place in meteors where physicists are trying to produce thermonuclear fusion.

At a height of 9,360 mi., there are 290 times more particles than at a height of 170 mi. on the sun's surface.

This means that of the 700 particles at 9,360 mi., only one falls down to a low altitude.

All other ions along the line of force, going from one hemisphere to another and back, do not fall down to low altitude.

The article said that there are grounds to indicate that the rate of exposure radiation around the earth consists mainly of protons, though no details are given. "Electrons at the outer zone present energies which are relatively small."

Space Technology

Military Limits Space Effort to 600 Mi.

By Paul Eastman

Washington—Military space effort in the immediate future will be limited to 600 mi. above the earth, according to Ray W. Johnson, director of Defense Department's Advanced Research Projects Agency.

Johnson told the House Committee on Science and Astronautics during a closed-door testimony released last week that military, though not yet clear, did not appear to be any present need for such interest in the future. He said that the military interest in the future, though not yet clear, did not appear to be any present need for such interest in the future.

Transfer of the lunar probe from ARPA to the National Aeronautics and Space Administration by the President was a clear indication that probes on the way of the moon were outside the military purview, at least for the present, Johnson said.

He said, however, that in this, this department would become concerned with space outside the 600-mi. limit when technology has advanced to the point to indicate that some military requirements beyond this area. The one exception was at this time, he said, is the 24-hr. automatic satellite scheduled to be placed into orbit at 22,000 mi. in the communications satellite program.

ARPA Developments

On other aspects of ARPA's assigned role in military space technology, Johnson stressed, and he said that the defense department would become concerned with space outside the 600-mi. limit when technology has advanced to the point to indicate that some military requirements beyond this area.

Johnson said that the defense department would become concerned with space outside the 600-mi. limit when technology has advanced to the point to indicate that some military requirements beyond this area. The one exception was at this time, he said, is the 24-hr. automatic satellite scheduled to be placed into orbit at 22,000 mi. in the communications satellite program.

those and obtaining the knowledge required to effect these interests in practical and highly efficient solid products.

Later phases of the Deaconville satellite program run on the Comstar Atlas intercontinental ballistic missile as a booster for larger probe capabilities will later be used, the program might include the 1.5 million lb. cluster booster being developed for NASA. (Private Deaconville satellite will be launching one vehicle a month for the remainder of the calendar year.)

Navigation satellite program is planned to provide an instantaneous, worldwide system for determining position at any point on the globe by means of radio frequency signals transmitted by the satellite as it circles over the horizon. Signal is instantly shifted up by the Doppler shift due to the satellite rate of approach to the receiver. Satellite will be the most accurate of the signal from the Doppler shift, a coded signal of transmission time and coded signal indicating the orbital direction in effect. In using this way, the position can be located within a matter of a mile.

Four tracked close-orbit satellites are expected to be delivered by Mar. along with six other satellites for military communications and other tests. First launched with the communications satellite, will be attempted to July as

August the second in February or March of next year. Three comets, strategically positioned as the satellite, will feed primary into secondary, and secondary into tertiary, as the comets are consumed. A thousand pictures will be produced every 24 hr. with each picture showing its detail as 500 television lines are resolved.

ARPA considers a future need for a national space data coordination center to serve the entire U.S. government, including NASA ARPA and its other agencies engaged in space activities. It would, Johnson said, be responsible for the categorizing all space-related, and the program should call for broad goals in data acquisition as well as in data collection and dissemination.

Advanced research in the development of a small defense satellite to ARPA's Project Deaconville. This is an intermediate on a second liberty ship, American Missile, recently launched to observe from the Atlantic Missile Range. Another program concerns the orbit vehicle America, which is equipped with a large variety of sensors and equipment. In addition, research studies are being studied at Wallops Island to observe small rocket flights and aircraft as being introduced with optical and infrared communication to study, through processes that take place during launch and reentry of a ballistic missile.

Military Aviation Funds

The military program had no budgeted funds for use in controlling its aircraft and fueling amounts of \$9.2 billion on Jan. 1. The corresponding balance totaled \$9.5 billion following an audit issued by Department of Defense.

	OBLIGATIONS (\$000 millions)			EXPENDITURES (\$000 millions)		
	July 1, 1970	Aug. 31, 1970	Sept. 30, 1970	July 1, 1970	Aug. 31, 1970	Sept. 30, 1970
Aviation Program	2,478,500	2,478,500	2,478,500	2,478,500	2,478,500	2,478,500
Av. Fuel	662,161	662,161	662,161	662,161	662,161	662,161
Av. Fuel	18,800	18,800	18,800	18,800	18,800	18,800
Total	3,160,461	3,160,461	3,160,461	3,160,461	3,160,461	3,160,461
Aviation Program	2,478,500	2,478,500	2,478,500	2,478,500	2,478,500	2,478,500
Av. Fuel	662,161	662,161	662,161	662,161	662,161	662,161
Av. Fuel	18,800	18,800	18,800	18,800	18,800	18,800
Total	3,160,461	3,160,461	3,160,461	3,160,461	3,160,461	3,160,461



Work Starts on Yondbenberg Titan Silo

First of three Titan intercontinental ballistic missile underground sites is under construction at Yondbenberg AFB, Calif., where the missile will be primarily trained although operational capability will be provided (AVW Mar. 9, p. 121). Tunnel will be similar to Titan base at Launch AFB, Calif., except the Launch complex will include three silos.

U.S. Space Lag Blamed on Bureaucracy

Los Angeles—United States is lagging behind Russia in the aerospace arena, not due to a dearth of technical talent, but because of a "lack of bureaucratic staff," according to Sen. Cleo Dingle (D-Calif.).

Speaking at the Western Space Age Conference sponsored by the Los Angeles Chapter of Commerce, Dingle said a surplus of government agencies and congressional committees hinders industry efforts to progress. Ching De Wenden, vice president of operations at director of the Development Division of the Army Ballistic Missile Agency, he said says Russia went twice monthly to the Pentagon for committee meetings. "And if that wasn't enough, from time to time the committee visited the Huntsville project," Dingle said.

Man-in-space projects set an example

of how project development, overlap, resulting in a "failing development program, become 'over the top' spread too thin." There are presently five man-in-space programs, run by the Army, Navy, Air Force, National Aeronautics and Space Administration and Advanced Research Projects Agency, Dingle went on to say, but, "suppose the Marine Corps does not have a man-in-space program?"

The Senator also cited the proliferation of agencies and "units" advising the President. "Here is an incomplete listing of the groups he turns to for assistance: the National Science Foundation, the National Science Board, the Chief Scientific Advisor, Dr. J. R. Killian, Jr., the Federal Council on Science and Technology (organized) by the President's Scientific Advisory Council,

the special advisory advisory, Gen. Ed. Quarrels, the National Security Council, the Federal Aviation Agency, NASA, the Bureau of Standards, and the Department of Defense with all its subdivisions such as AFMFA and guided missiles and the military services. If Mr. Eisenhower wanted to know about the value of a certain proposal, I doubt if he would be sure where to turn or whether he could get better information from someone other than the adviser he was consulting."

Sen. Dingle said he didn't know all the answers to the problems plaguing contractors as a result of excessive government bureaucracy, but that it was an important challenge to our sense of government to prove our ability over Russian contractors.

Massive Retaliation

Doctrines of the military value of a satellite-piloted bomber (see p. 67) were attacked during the conference by F. A. Cleveland, chief adviser design engineer for Lockheed Aircraft Corp.'s Georgia Division. He said the concept of massive retaliation is treacherous. "Enough of the retaliatory force is unvulnerable to nuclear attack."

Retaliation force is capable of finding and destroying enemy's mobile strategic striking force as well as large fixed targets.

The first point is important since it is the requirement that we be capable of winning the war if the deterrent threat fails. A nuclear bomber, being launched, has the capability of seeking out the different targets and taking appropriate retaliatory measures. It is the only approach because nuclear damage is not done in a high altitude approach.

The trend in development of bombers has been toward greater speed and higher altitude and defensive systems have been oriented to cope with those trends. Such an orientation has become more serious because the defensive system is so complex, consisting of radar, aircraft, warning, search and tracking equipment and an enormous communication and data collection network. Recent estimates of the effort to mount runs of high altitude attack close breaks indicate that strikes into the high altitude approach can be sustained significantly. Cleveland said, "Based on USARP and Lockheed studies indicate that attacks due to extensive defenses would be relatively slow in the low altitude approach. Evading chemical-fuelled bombers can use the

low altitude approach but reduce of action is sharply limited. Only modest payloads allow combination of maneuverability and range in low altitude. A high altitude bomber passing over a radar station can be detected for over 15 min. but not passing at minimum altitude can be detected for only three minutes. Studies show that over 40 times as many radar sites are needed to maintain a tight defense perimeter against low flying intruders in against high altitude. High speed bomber interception and tracking of low intruders is difficult because the intruder presents the corner with many extremely broad angle sightings. The difficulty of identifying and tracking is compounded if there are several intruders nearby flying various courses. The intruder is faced with an extremely difficult data correlation problem.

Interception and attack are difficult because of the direct range of detection and tracking and because an airplane close to the ground does not present an easy target to airborne radar and infrared detection because of ground clutter. Short tracking range means interception has to get within into a tail chase in which they are likely to expend fuel before getting within range.

Cleveland also described USAF's nuclear-propelled, continuous, airborne missile launcher and low level system (CAMAL). He called the airborne conventional except for the variation needed to protect against nuclear damage. No external design or fabrication methods are required to produce the system. "The propulsion system itself, which is today in a rapidly developing state, is also designed by today's state of the art. Even basic concept regarding system has been evaluated, tested and refined in the laboratory or in the actual hardware itself," he said. While shuddering at CAMAL, he was, however, it does not approach the weight of his chairman's idea of an atomic power. Cleveland said:

- CAMAL is no larger than present Strategic Air Command bombers.
- CAMAL comes more potent than present SAC vehicles.
- It will be able to operate more than 100 hours per year than current bombers able of standby full operational status.
- It can operate from present runways of SAC bases.
- One mission will surely hit more than one target in the air despite the absence of any significant limit on range or endurance and despite the fact that doubling will permit twice the number of hours per year in conventional aircraft for 18 times without exceeding AEC limits.
- It has launch long range air-to-air missiles against individual targets and this long range and altitude for its attack against hardened installations.



General Electric Unveils T64 Turbine Engine

First photo shows complete General Electric T64 free turbine engine which has entered development testing at GE's Small Aircraft Engine Dept. Engine, being developed under \$16.5 million Navy Bureau of Aeronautics contract, may find primary action in which individual units can be added to make a turbo-prop or turbofan engine (AW May 30, 1957, p. 34). Engine is rated as the 1,600 hp class.

News Digest

Solid payload recovery needed on which Project Mercury passenger will depend for safety measures during 160 sec of acceleration to orbital altitude will be designed, developed and tested by General Control Reel Co. as part of a subcontract awarded by McDonnell Aircraft Corp.

British government will contribute half the remaining cost of developing an advanced version of the Talon, three drive VTOL transport, although the figure has not been revealed.

Irish Airlines will order three Boeing 720 aircraft stage jet transports for its European and transatlantic routes Irish government sources give the price at \$12 million per airplane.

George F. Sifton, Jr. has been named chief scientist of the Advanced Research Projects Agency to fill the post left open last December when Dr. Robert Taylor became Defense Department's Director of Research and Engineering. Last September, Sifton took a leave of absence as manager of all varied designs for Rocketdyne Division of North American Aviation Inc. He became Hamilton Professor of Aero-

nautical Engineering at Massachusetts Institute of Technology, Boston before becoming Director of Science and Master of Science degree at California Institute of Technology.

Fiber Astro light-transmission glass parachute control the underground glide tests near Lake Havasu, Calif., taking the pilot, Robert Piggott, "out of the airplane seat" about 25 mi from the wreckage.

French government is considering placing a limited order for a large version of the Dassault Mirage IV from its bomber which may be powered by Pratt & Whitney JT7 turbojet engines. Current studies set for first flight about month is powered by SNECMA At 9 engines.

U. S. Army has awarded contracts totaling \$23 million to Bell Helicopter Corp. for production of HU-1A and H-131 turbine-powered helicopters.

Karlo Corp. of America's Electro-Tube Division says it has an approach to development of subsonic-powered close range tanks particularly aimed for missile mounted machines. New design called "Nimrod" is aimed at reducing vehicle size and power drain and increasing performance.



LOCKHEED at the Western U. S. Lockheed Aircraft Corp. satellite is displayed at the Western Space Age Conference sponsored by the Los Angeles Chapter of Commerce.

Latin Rate War Nears Showdown Stage

Predicted settlement of fare cutting dispute not expected to trim foreign-carrier competition.

By L. L. Doty

Miami—Strong rate-cut war has been waged since 1980 between all Latin America and the Caribbean for the past five years finally appears headed for a showdown.

However, any settlement of the conflict, which reached its peak with the under-cutting of established fares by as much as 40% by some South American carriers, is not expected to stem the torrent of competition that has built up against the U.S. airlines. Despite the apparent harmony reached on the rate and fare issue, hidden protective barriers—created by the strong surge of automation that has swept the Latin American continent since World War II—will continue to stifle attempts by U.S. carriers to meet that competition squarely.

Many observers look close to the Latin American picture feel the fare wars will be resolved and become the underpinnings of new international routes. The possibility of being undercut thus serves to encourage U.S. airlines and other member carriers of the International Air Transport Association (IATA) to change their 100% loss tolerance to the 10% allowed by nonmembers of IATA.

Latest Developments

There are the latest developments in the airline situation in South America:

Meeting of governments in Rio de Janeiro in January (AW Jan 29, p. 18)

Created an air of optimism that an equitable fare pattern could be reached that would bring a halt to continued competition. Participating countries agreed to proceed that IATA fare levels would be set as standards in South American rate structure. Meanwhile, present fares have been frozen temporarily to shore off an about one-half U.S. airline carrier on IATA standards.

Meeting of airlines executives in South America, scheduled to begin, later, at Lima for the purpose of setting rates has been postponed temporarily. U.S. is making for assurance that rate of cost recovery and most common carrier will be lowered before any meeting on fares is convened. Otherwise, the postponement does not indicate a delaying action on the part of South American carriers, but that it is simply the result of true cost-cutting efforts to coordinate all countries on all fare issues involved.

South American carriers are still determined to impose strict controls on IATA fare structure. These airlines are insisting that 75% of all traffic flow between the South American countries

should be diverted to the flag carriers of those countries.

Small behavior of 35% to be flown on U.S. carrier will have a depressing effect on gross revenues of those airlines, according to officials of companies here.

Principal problem has in the large number of airlines which are sensitive to the Latin American and Caribbean markets. And of the 61 carriers competing for business in their area, 17 operate to the U.S. as compared with 14 scheduled airlines that serve the U.S. through the transatlantic route.

Among the scheduled carriers competing for business throughout the entire eight major European sectors, with KLM, for example, serving as much as 28 cities in Latin America and the Caribbean. Japan Air Lines has also begun to begin scheduled service to the South American route to add to the competitive battle for traffic (AW Dec 29, p. 10).

Latin American Story

Despite new among South American carriers has focused attention on the problem U.S. airlines are facing in the development of Latin America as a market. Following a series of events among Latin American, American World has prepared a series of two articles involving the rates issue costing two problems. The assumption made across the line was that it was about a round about next week will deal with specific trade problems as they are related to rates and to the bilateral pact between the U.S. and Latin American countries.

Majority of the South American carriers are IATA members, and as all U.S. flag carriers offering scheduled passenger service south of the U.S. border—American, Braniff, Delta, Eastern, National, Pan Am, Pan American and Western. However, in the foreign carrier group, there are 15 non-members of IATA which refuse to abide by IATA fare standards and they begin after the below fares charged by their competitors.

Round Trip Rates

For example, CINTA, a Chilean airline and subsidiaries, a Chilean, operates a line of 2115 round trip between New York and Santiago as compared with the 3771 60 round and 3933 40 fare class are published by Pan Am. American Airlines offers a 3475 50 round trip fare between New York and Santiago as compared with Pan Am's lowest fare of 3771 round trip between the two points.

Attempts to force such airlines to take their rates to more reasonable levels have failed in the past. Generally, these airlines have been able to survive lower revenues because of low costs.

They have purchased investment aircraft with low without charge and kept wages close to minimum levels. They have also covered costs through such devices as renting ground equipment from airport operators or other means for the short periods of time it is actually needed and used. Also the entire fare generally covers service to the plants, profitable routes leaving the low producers aside to IATA members.

IATA Conference

To combat these fares, the IATA traffic conference held in Geneva last year (AW Oct 27, p. 26) adopted a resolution which permitted IATA members to reduce their fares and travel fare to South American carriers in a bid to lose less than 50% of the current fare available on the routes in question. The Civil Aeronautics Board approved the decision and later confirmed its stand when the 11 non-members of IATA protested.

Thus, according to airline officials here, these carriers now face the threat of being undercut and are ready to make plans in the present war to make plans in the future that the 11 members will take advantage of the opportunity to join IATA and give them

win under the pledge of IATA officials.

First signs that harmony could be reached appeared when the South American carriers met last December in members of the Association Latino-Americana de Transportes, a trade association of the Latin American carriers. At that time, René Pinco, head of CINTA, attempted to push the fare rates but acknowledged that some settlements might be reached. Rubén Parada, president of Braniff-Vietnam IATA affiliate, has led the move to resolve the fare issue.

However, the fact situation is not the main factor that has delayed U.S. carriers in meeting South American competitors on even terms. These other elements—currency exchange, agents' commissions and the general neglect of traffic—also by U.S. flag carriers from operating on a free market.

The first two of these three issues appear headed for a settlement as a result of agreements reached at the January Rio de Janeiro meeting. In fact, they are not resolved. U.S. carriers are little point in any further discussion of the fare issue until both the agents' commissions and currency exchange issues, in they are resolved, could make a contribution of sharp rate reduction.

On the currency exchange problem, it was unanimously agreed that the U.S. dollar will be used as a standard in the construction of fares. In addition, it was decided that a free market rate of exchange will be adopted as a means of stopping the opening rate of prices on airline travel.

Such resolution has provided South American carriers a net profit of as much as 15 to 20 cents on the dollar.

For example, current rate of exchange in Chile is about 1,000 pesos to the dollar. However, airline fares are based on the peso but are set at 110 to 120 pesos in the dollar to create a tremendous competitive advantage over current selling similar fares in dollars at the open market dollar exchange rate.

Use of the dollar as a standard fare construction and the adoption of a free market rate of exchange will strike U.S. carriers that all passengers of any point of purchase will pay an equal value for airline purchased between any two points.

Second issue on which agreement was also reached concerns agents' commissions. U.S. carriers have charged their high agents' commissions of as much as 30% designated for travel agents. Argentina and some other countries do not necessarily go to the travel agent, large portion of the commission is absorbed by the airline. In the past, passengers purchasing the tickets in a hidden manner of granting a reduced rate on tickets.

TWA to Start Jet Flights; Seems Sure of Getting More 70s Soon

By Glenn Garvin

New York—Time "World Airlines" plans to begin transatlantic jet service Friday with a single Boeing 707-120 as probably based on an estimate of early additional deliveries, although Howard Hughes' original aircraft carrier last week still surrounded TWA's fleet.

TWA's fleet, originally, however, is about to add all Boeing's two at Boston, Wash. Two of the jet were at the Boeing field maintained delivery center last week in TWA's new aircraft fleet were on the flight line at Boston, and two were on the factory floor for final checkout.

Airline received its first jet several weeks ago and has been using it for training, but that is no 707. General Electric (GE) turbofan engine, and cannot be used for backup in the scheduled service until its installation is completed. First NC (non-scheduled) service was last at Kansas City last week, and the plane will assume the usual transatlantic task.

Hughes Tool Co., which takes delivery on TWA's planes and delivers them to the airline, ordered the jet assigned at least one firm financing for jet purchases, because Boeing terms are in its only after final payment has been made. The two planes have been made in the Port & Whitney plant, but had not definitely made up its mind whether this option would be used or whether the engines would be overhauled at TWA's own Kansas City maintenance base.

The airline has been accumulating ground equipment for its jets and a new set up of 100,000 to handle these engines and refueling parts are purchased at various points.

For engine status, TWA has both the Ace start bottles and Boeing Turbochargers at Idlewild. One Turbocharger unit has been delivered and another is on order. Expenses will determine which will be replaced over the airline's stock for getting an average 707-120 into international service as scheduled as he continues the test.

Construction of the factory-design TWA building (started in AW Nov. 15, 1977, p. 40) has been delayed, according to the airline, by various factors, including the fact that the contractor is in excess of \$10 million, but not, however, for the \$5.5 million had been voted for the project.

are exhausted. The airline last year agreed with Flight Engineers International (AFA) guaranteeing the machine would operate at jobs until late next year, 1981.

TWA is prepared to begin jet service with experienced pilots of that career experience. Line pilots have been flying light and ground jet training and the airline expects to have about 20 fully checked out pilots by start of service. Boeing 707-120 production was put into use within three months.

TWA will offer 40 first class and 60 economy seats on the new New York-San Francisco run. Scheduled times are 4 hr. 40 min. eastbound and 5 hr. 40 min. westbound. Daily departures from San Francisco is scheduled 3:30 p.m. and from New York the New York departure is at 9:30 a.m. local.

By way of comparison, American Airlines started its New York-Los Angeles service with two 747 jets, a 747-100 and a 747-200 and presently, according to the airline, has a fleet of six of the 707-120s. And American was able to negotiate service from both cities simultaneously.

TWA will perform its first maintenance at New York, with term annual servicing at San Francisco. To ease overhead procedure last week was still underway, TWA said. The airline has been negotiating for possible entry into the service of the Port & Whitney plant, but had not definitely made up its mind whether this option would be used or whether the engines would be overhauled at TWA's own Kansas City maintenance base.

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World's newest, fastest long-range jetliner... the Boeing 707 INTERCONTINENTAL

The Boeing 707 Intercontinental, shown above on its first flight, will bring a new order of performance to the air routes of the world when it goes into service later this year.

This new Boeing jetliner has greater range and payload capabilities than any other jet transport. With a range in excess of 5,000 miles with full

payload, it is designed to fly nonstop over the longest stages of airline routes. Cruise speed is more than 600 miles per hour.

The Intercontinental is a longer-range sister ship of the 707 Stratoliner. Although it is the world's newest long-range jetliner, the Intercontinental is a proven aircraft... backed by more than 48½ years

of flight testing of the 707 prototype, as well as extensive test programs completed by production 707s. In service since last October, the 707 Stratoliner has been demonstrating the unparalleled passenger-appeal of Boeing jets. Public response, in the words of the operating airline, is "the most enthusiastic to a new airliner in aviation history."

These airlines have ordered 707 and shorter range 720 jetliners (includes Intercontinental purchases):

*AIR FRANCE • *AIR INDIA • *AMERICAN • *AIRLIFT
*BRITISH • *CONTINENTAL • *EAL • *EASTAFRICA
*PAN AMERICAN • *QANTAS • *SABENA • *SOUTH AFRICAN
*TWA • *UNITED • *VARIG • *JAL NIPPON

BOEING 707 *Intercontinental*



LOS ANGELES AIRWAYS Sikorsky S-55 helicopter delivers passengers in United States' flight. Note passengers "swivel".

Los Angeles Airways Plans Turbine Fleet

By William S. Reed



SWIRLY S-55 takes off from Long Beach Municipal Airport (above). During passenger delivery flights, the helicopter's rotor tips are mounted but blades are in flat pitch, pushing maximum downwind disturbance to the passengers. Company installed seats that swivel with rotating helicopter convertible from passenger to cargo seats in 3 min.



Los Angeles—Los Angeles Airways plans to convert its helicopter fleet to turbine-powered aircraft to take advantage of a potentially large traffic growth in the sprawling Los Angeles metropolitan area.

Two factors are unique to the area: • **Indispensability of public transportation.** • **Thunderous growth in both population and area of Greater Los Angeles.**

Daily congested passenger helicopter operations in this area, Los Angeles Airways already is tapping the market for about 50,000 passengers per year, a high truck small percentage of the 5,500,000 persons who used the airport last year that future growth figures indicate the need for new equipment to capture the huge potential market. Factors for the latter, Comptroller estimates by the City of Los Angeles predict that the passenger volume in and out of the airport will reach 11,800,000 annually by 1969.

Swivel is the fastest growing component in the world, Greater Los Angeles owns some 5,000 sq. ft. in aircraft about 100 separate but clustered offices with a total population in excess of 7,000,000 and growing rapidly.

Public transportation similar to New York and London industries does not exist. R. P. Hubler, Los Angeles Airways traffic manager, points out that public transportation in Los Angeles mostly based with a few streetcars, almost at the rate of 95 mph. Add to this the increase in traffic and the fact that the increase in traffic is not in the metropolitan area is not in the metropolitan area.

Although passengers in today's jet aircraft make the Los Angeles-New

York trip in 45 hr., their new speed is much as 1 to 1.5 hr. in many cases, as well as, depending on distance from the airport and mode of transportation. Helicopter service cut this time from 10 to 30 min.

Los Angeles Airways believes it will grow along with the general increase in passenger traffic because it has "had to run down 10 requests for every one passenger carried." Explaining for the inability to accommodate the number of requests has in the limitation of present equipment.

Biggest drawback, in today's operation for Los Angeles Airways is relatively low payload (1,380 to 1,500 lb.) and high operating costs of the Sikorsky S-55, a design that was not intended primarily for value passenger operations. Operating for \$5.50 and two S-55s (fuel for cargo each, and some to be placed on it), LAA pays \$1,603 passengers in 1958, and slightly less, \$1,583, in 1957.

Lack of income resulted from a shortage of passengers and cargo because of the helicopter's limited payload capacity and unwillingness of LAA to equal service with new equipment which can earn a greater payload and operate more profitably, is variable.

Expansion of LAA as that adding more S-55s or purchasing an other helicopter available now, would not decrease passenger or income costs.

For this reason, Los Angeles Airways is working for delivery, now arriving late in 1960 or early in 1961, of the Sikorsky S-61, a 25-passenger helicopter powered by two General Electric T55 gas turbines. Los Angeles Airways believes that the S-61, scheduled for an unveiling at Atlantic City late in May (AVP 21, p. 45), will permit profitable operations. As an interim measure, however, it plans to purchase two Sikorsky S-61s, primarily for the experience in

turbine operation, but also because it will allow a 30% increase in payload over the S-55.

The S-61 has the following performance to the S-55: more and tall rotor blades, more and tall rotor hub, more gear box, with new gear set, with new, intermediate gear box, tall gear box, shifting, major portion of flight controls, including engine, major portion of hydraulic system and tall rotor hub (AVP Aug 23, p. 64). Estimated of operating expense for the S-61 also that it will operate for the same cost per passenger made in the S-55.

Once LAA has put its new equipment into service, the more after profit will be added to other turbine aircraft then operations. The cost of converting its helicopters in high ranging from \$7.50 to \$8.00 for a narrow path depending on delivery method. Airline passengers, serving helicopter service in connection with other American Trans World Continental or United Air Lines routes through a bilateral agreement, the transportation to the airport for \$2.00 added to the ticket cost. Major portion of the difference in cost is borne by the major carriers, but is allocated to flight destinations beyond Kansas City and points of origin destination.

Commenting by helicopter has not proved too popular to date, both from the standpoint of cost and helicopter to others. Should the City of Los Angeles consider a helicopter airport? The service might then prove attractive. Los Angeles Airways believes more the actual passenger market has been used, attention can then be turned toward converting to other fast-growing up the difference in helicopter is kind was maintenance in the logging of other free, general operation of which accounts for about 15% of the total flying time. In August 1958, the percentage of time spent in flight actual work and in support on the machine, time is logged continuously from time start to stop. The 15% figure is included in helicopter maintenance time, but is subtracted from the operation figure so that each helicopter is actual flying time, rather than total time.

Another operation is a factor which is still being weighed by the company in future planning. Present helicopter completion is 92%, despite the fact that the company must operate under visual flight conditions. Scheduled are loaded up by increasing service and the company's record of getting passengers to the airport in time for flights has been good. Los Angeles Airways makes about 100 flights per day from 4:30 a.m. to 11:30 p.m., the time of heaviest actual traffic.

The aircraft would be to offer 24 hr. service and to operate in new weather. Adding the necessary weight is a liability operation, but also because it will allow a 30% increase in payload over the S-55.

Figure annual life on the S-55 is now at 708 hr. rotor blades are changed at 500 hr. while transmissions must be replaced at 1,000 hr. All routine and periodic maintenance is performed at the company's facilities at Los Angeles International Airport.

Helicopter maintenance, according to Los Angeles Airways' shop chief is much more routine and complicated

Los Angeles Airways

Air Mail Carried

*1947	209,325 lb.
1948	2,975,680 lb.
1949	4,318,773 lb.
1950	4,424,652 lb.
1951	4,786,970 lb.
1952	4,635,777 lb.
1953	5,624,223 lb.
1954	6,346,912 lb.
1955	6,615,642 lb.
1956	5,714,347 lb.
1957	6,552,067 lb.
1958	4,159,469 lb.

*From Oct. 3, 1947

Air Express Carried

*1951	5,168 lb.
1954	686,526 lb.
1955	1,546,940 lb.
1956	1,628,660 lb.
1957	1,670,358 lb.
1958	2,028,183 lb.

*From Dec. 17, 1953

Passenger Carried

*1954	710
1955	4,951
1956	28,846
1957	51,789
1958	51,946

*From Nov. 23, 1954

First S-62 Orders

Los Angeles Airways is the first of its kind to place orders for the Sikorsky S-62 helicopter powered by two General Electric T55 turbine engines and having no amphibious hull.

The order book which totals five: • **Los Angeles Airways**—order for two ships for delivery possibly by this year or only next year, depending on actual delivery of engine.

* **Robert A. Venturi, Calif.**—option on one ship.

* **Peninsula Helicopters, Inc.**—option on one ship.

* **New Service, Philadelphia**—option on one ship.

Completion of the S-62 is scheduled for November and deliveries will commence about that.



Convair 880 bedrock transport, now undergoing flight testing at San Diego, Calif., will carry 56 passengers in first-class configuration.

Convair 880 Jet Transport Enters Flight Tests



Intercontinental version (not yet built) of the Convair 880 will have 4,210 mi. range. The four General Electric CJ485-3 turbojet engines are commercial versions of military J75. Engines are fitted with duty-type windup governors with thrust reverses planned.



Another Convair 880 currently is undergoing proof load testing on the ground; side-wing fairings will be pressure-tested under water.



Transport shown in "climb" configuration, now built at the rate of 17,000 lb. per hr. to maintain top cruise speed of Mach .95.

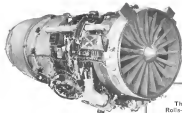
A NEW ERA IN JET POWER



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The new RB.141 family of by-pass jet engines is based on seven years' development experience of the by-pass principle gained with the Conway and on six years' operation of other gas turbine engines in airline service. The first of this series has already been chosen to power the new British European Airways medium range jet airliner.

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THE TYNE

—a most advanced prop-jet engine, is due to enter service in 1960 at ratings of 4,565, 5,525 and 5,730 h.p. It has a specific fuel consumption comparable with the latest compound piston engines.

THE AVON

—the first turbo jet on the North Atlantic route, and now in daily service, began scheduled operations with an approved overhaul life of 1,800 hours.

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ROLLS-ROYCE LIMITED, DERBY, ENGLAND

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Airline Traffic—Year End, 1958

	Enroute Passengers	Revenue Passenger Miles (RPM)	Load Factor	M. S. Mail	Express	Freight	Total Revenue Ton-Miles	% Revenue To Available Ton-Miles
DOMESTIC TRUNK								
American	7,228,130	1,976,581	66.1	25,845,819	9,857,719	91,177,371	99,880,909	37.1
Boeing	3,151,166	1,111,343	71	2,311,141	2,025,879	6,700,412	107,954,872	40.8
Calvert	2,341,899	1,418,889	59.9	6,703,820	3,829,261	2,771,890	147,723,181	37.4
Continental	835,021	420,446	59.5	1,267,595	642,831	1,199,231	44,292,961	32.7
Delta	2,953,388	1,636,810	66.2	2,387,412	2,389,401	12,086,954	166,155,811	33.4
Eastern	4,194,671	3,613,473	88.79	1,891,228	1,896,734	12,671,234	183,280,751	44.16
National	1,246,318	1,201,410	96.1	1,444,810	750,838	4,233,926	107,494,233	47.7
Northeast	1,007,741	1,020,222	97.4	1,107,074	572,469	1,724,957	41,669,469	39.3
Northwest	1,563,244	1,126,140	84.4	3,470,179	2,429,393	11,123,490	107,360,190	47.0
Trans World	4,496,384	3,671,414	81.4	12,454,528	7,054,422	36,307,477	264,107,811	50.0
United	1,743,947	4,199,344	104.4	9,132,263	11,024,427	46,094,129	343,497,642	59.7
Western	102,321	204,711	34.3	2,195,144	719,684	2,814,575	55,736,394	44.4
INTERNATIONAL								
American	126,365	114,999	28.8	114,964	8,211	2,311,139	16,426,216	36.0
Boeing	66,439	85,702	44.8	120,493	1,381,240	17,969,255	44,770,447	44.7
Continental-Alaska	262,421	12,476	39.6	16,103	42,251	1,113,441	44,970,447	44.9
Delta	97,184	48,015	11.9	12,381	684,814	8,194,146	47,970,447	44.9
Eastern	543,369	497,159	99.96	68,636	1,233,927	11,274,411	121,274,411	31.71
Maxair	92,028	39,116	40.0	0	35,106	9,896,447	41,370,447	41.3
National	102,368	49,203	31.7	118,033	807,442	7,706,136	44,670,447	44.6
Northeast	146,156	215,007	68.8	12,107,461	201,120	7,713,739	56,887,296	48.7
Pen Airways	43,014	48,271	34.9	126,349	1,480,603	7,946,566	43,070,447	43.0
Alaska	1,582,101	1,812,010	44.0	14,171,764	39,473,367	102,388,346	199,970,447	39.9
Latin Airways	1,147,116	1,244,263	44.0	3,787,146	20,148,327	177,964,346	199,970,447	39.9
Pacific	364,869	948,999	79.9	1,457,417	106,434,477	106,434,477	199,970,447	39.9
Passage	129,779	145,201	59.4	608,667	5,121,634	50,649,149	107,970,447	37.1
Realt	100,000	100,000	100.0	0	43,999,779	43,999,779	199,970,447	39.9
Trans World	310,959	395,793	56.8	16,164,161	16,736,844	107,911,160	199,970,447	39.9
UNICA	1,122	742	1.0	1,000	1,000	1,000	199,970,447	39.9
United	301,170	331,201	41.3	1,072,450	1,011,169	26,315,861	199,970,447	39.9
Western	17,176	26,763	10.0	16,164	64,641	2,406,126	199,970,447	39.9
LOCAL SERVICE								
Allegany	475,692	86,184	42.3	129,462	216,104	725,719	6,499,714	49.4
Alaska	149,384	42,304	16.4	44,212	21,120	6,328,216	49,770,447	49.7
Canair	139,890	38,873	36.4	44,341	34,490	107,341	3,744,200	36.6
Frontier	221,123	10,790	39.1	229,449	705,264	7,094,369	199,970,447	39.9
Jetair	182,081	10,790	39.1	43,271	174,268	6,612,000	49,770,447	49.7
Midwest	149,746	47,361	33.6	11,427	142,714	179,483	9,771,276	33.3
Northwest	241,454	121,811	46.0	406,476	406,476	10,749,814	49,770,447	49.7
Oak	425,773	72,373	38.7	111,416	115,350	7,444,808	49,770,447	49.7
Pacific	372,718	85,660	41.4	124,426	37,213	6,346,820	49,770,447	49.7
Pennair	414,841	126,416	44.0	145,508	120,432	4,716,374	49,770,447	49.7
Seaboard	222,134	49,839	39.9	111,446	120,363	81,469	4,888,808	39.9
Trans World	125,400	56,134	38.1	196,164	101,438	100,412	4,888,808	39.9
West Coast	208,624	46,820	47.75	36,119	76,742	184,894	4,888,808	40.71
BALANCE								
Boeing	109,893	86,645	61.9	39,119	1,006,022	5,175,738	10,470,447	10.4
Trans-World	195,803	24,741	34.0	1,175	1,166	5,170,849	10,470,447	10.4
CARDO LINE								
Alaska	111,416	111,416	100.0	20,324	40,364,210	46,446,394	79,970,447	79.9
Continental-Alaska	2,103,470	2,103,470	100.0	1,103,470	6,103,470	6,103,470	79,970,447	79.9
Thru Time	475,416	340,073	59.4	475,416	480,770	14,073,440	141,068,540	68.8
Frontier	221,123	10,790	39.1	229,449	705,264	7,094,369	199,970,447	39.9
Jetair	182,081	10,790	39.1	43,271	174,268	6,612,000	49,770,447	49.7
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Trans World	125,400	56,134	38.1	196,164	101,438	100,412	4,888,808	39.9
West Coast	208,624	46,820	47.75	36,119	76,742	184,894	4,888,808	40.71
REPUBLIC LINES								
Chicago-Milwaukee	109,136	1,799	39.5	17,414	0	0	256,191	39.5
Los Angeles-Albuquerque	21,442	1,761.5	32.1	46,002	22,337	0	153,234	34.4
New York-Albuquerque	91,114	1,241	44.6	17,422	13,374	4,127	508,618	44.6
ALASKA LINES								
Alaska Airlines	72,079	31,446	36.4	442,301	26,876	2,738,221	2,716,421	43.4
Alaska Coastal	51,444	4,444	61.6	44,341	49,441	76,716	669,441	61.6
Coastal	41,444	4,444	61.6	44,341	49,441	76,716	669,441	61.6
Coastal	31,444	3,144	39.0	34,003	39,003	34,003	34,003	61.7
Northwest Coast	21,444	2,144	44.4	21,171	21,171	21,171	21,171	44.4
Pacific Northwest	11,444	1,144	44.4	11,444	11,444	11,444	11,444	44.4
Seacoast	11,444	1,144	44.4	11,444	11,444	11,444	11,444	44.4
West Alaska	11,444	1,144	44.4	11,444	11,444	11,444	11,444	44.4

* Not available.

Compiled by AIRLINE WEEK from airline reports to the Civil Aeronautics Board.

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AUTAIR HELICOPTER SERVICE, LTD. AND ALDUETTE

Autair's Alouette equipment is the first purpose-built helicopter service in Canada. While still new in Autair's rapidly expanding services, Alouette* led a dramatic and dangerous mission.

A German freighter, dangerously low on fuel, had been ice-locked for days in the St. Lawrence River. Even if an ice-breaker could have gotten through, the nearest refueling site was 108 miles away. Autair-Alouette came to the rescue. Carrying 1,000 pounds of oil each, Autair delivered its cargo. Nothing stopped Alouette—snow, frostbite, wind, visibility, nor a half-inch of ice on the blades. Maximum pitch was no more than 13½ degrees. In 11 below zero weather all starts were immediate, and the operation resumed several times.

In Autair's many activities—power line construction work, patrols, hydrographic surveys, and freight and passenger charter—Alouette has proven its all-purpose dependability in all weather.

*Designed by Sud Aviation

The Alouette is assembled, tested and distributed by:
REPUBLIC AVIATION CORPORATION

HELICOPTER DIVISION

Port Jervis, Long Island, N. Y.





HANDLEY PAGE H.P. 2 Victor bomber utilizes constant wing planform. Ram air scoops on aft fuselage provide equipment cooling air.

Sandwich Panels Cut Weight in Victor

By John Twestall

London—Extensive use of spot welded sandwich construction in wing, fuselage, lower, upper wings, fins and tail plane are among notable weight saving, dimensional and full-size aspects of the Handley Page Victor bomber.

These aspects include high efficiency transport wing joints in the sandwich which feature lines on both halves in line with the contour of the panel cross section.

Sandwich construction gives a major part in the particularly low structural weight allowed for the Victor and the exceptional weather stability and smoothness of its standard "constant" wing configuration.

Another weight-saving feature is the extensive use of suspension bracketry, savings for detailed components. Tolerances in the rivets near the engine bay and in nose holds are 250 ft.

Quoted features include the use of steel bars in the operation of elevator cables and aileron which enable the control mechanisms to be kept within fuel containers.

According to E. R. Oliver, design chief engineer at Handley Page, structural efficiency of the Handley Page sandwich construction over a basic cant structure is due to the non-whisker skin closely joined corrugations in the direction of the principal load—during the fuel load and primary bending stresses with the outer skin. Heavy cant can take no load, it merely shears the section.

Sandwich skin panels used in the



STRUCTURAL efficiency is emphasized in this view of Victor at top of a loop.

AVIATION WEEK, March 16, 1959

MAN WITH A MISSION ... AND A MESSAGE

From the quiet, serene "emptiness" of Space will come the message transmitted by this man and by the sensitive equipment which studies him within fractions of seconds — almost imperceptibly —. Space events will be symbolically interpreted.

That is the mission given mankind. Though the lone man in Space will have no hand into a region dominated by seas of stars, the path behind him will be flooded with light — a light that focuses the message to the sensitive equipment below. This illuminating knowledge will light the way deeper — ever deeper — into the darkness that still lies ahead.



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RADIGORDER is a series of small instruments displaying data of interest. It is the latest in the line of instruments, Alpha Numerical Display, in 1959.

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The King of Air Fighters

(Continued from *Birds Prey Cover*)

thousand feet and headed for home. A flight commander from Squadron 74 had just saved the life of one of his pilots by drawing the enemy on to himself.

Such a man was Britain's Edward (Mick) Mannock—an irreplaceable fighter, a cool, calculating tactician, the greatest fighter pilot of World War I. That sturdy patriot was accepted by the Royal Flying Corps despite a bad left eye and the handicap of age, for Mannock was 38 when he arrived in France early in 1917 for assignment to a fighter squadron.

An Irishman who had been born on the wrong side of the tracks, Mannock joined the army before the war, following five years of travel in the Middle East. He served in the ambulance corps and with the engineers before being transferred to the R.F.C.

Unfortunately, he was without a natural flyer and a good shot. Both took practice, and it was two months before Mannock shot down his first German. He proceeded cautiously at first—often to the chagrin of his comrades—but within three weeks he tagged five more enemy planes.

Mannock scored the majority of his 73 victories in an S.E. 5 in S.E. 5a, the swiftest of the R.F.C.'s high altitude air defense. The British-built S.E. 5 was famous for its dive-and-zoom maneuvering. Originally powered by a 150 hp Hispano-Suiza engine, its maximum speed was 119 mph at 6,700 feet and 98 mph at 15,000 feet. One Vickers machine gun had to be added to the prop, and a Lewis gun could be swung from the top wing to shoot upward. The plane was as easy to handle as the Sopwith Camel was difficult, but it couldn't match the Camel for maneuverability. First production models were delivered at about the time Mannock arrived in France.

During the latter part of 1917, Mannock was amassing a victory a day in



MICK MANNOCK
in victory day

(Advertisement)



his S.E. 5. Before the year ended he had 55 confirmed kills and won a flight commander. It was as a flight commander that Mannock added to the roster of his name. This impressive air fighter was equally great as a flight leader. Although he was protective of his young pilots, Mannock had no patience with the shortcomings of the more experienced fliers under his command.

The year 1917 was the year of heroes. Mannock became the No. 1 air fighter of the Royal Flying Corps—and his only fear was death by fire. He crashed a period with which to end his own life in crash-landed plane was not after Mannock never had a chance to use the gun.

Late in June, 1918, Mannock was dogfighting. In following an enemy plane down to confirm the kill, he flew too low and was killed by a German machine-gunner's bullet. Shortly afterward, his father accepted Mick Mannock's Victoria Cross from the hand of the King of England.

Heritage of the Air

One of the most inspiring chapters in the history of flight is the story of the men and flying machines of World War I. It is a highly personalized story of heroism—and the moral valor and tenacity that converted manpower to airplanes.

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Free Reprints for Framing...

Color prints of the cover illustration of Mick Mannock's S.E. 5a and other World War I planes are available for framing. Receive a set of these color prints—complete with scale drawings and specifications—by addressing requests to company letterhead to Heritage of the Air, Leach Corp., 19435 Sesena Rd., Compton, Calif.



NEXT TIME...

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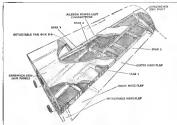


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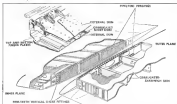
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SANDWICH die compresses two quarters in the Victor's primary structure, clamping in the secondary structure



DRAWING illustrates paper joint forgings which locate the truss webs in contrast of the panel sections. Finger plates are detailed at top left.

load transfer built located between the legs, and in the main plane as the method of the sandwich construction. Virtual shear at the joints is resisted by engagement of dog teeth, bringing projecting flange front and rear spars webs. Flare and air stream loads are reacted by the bolts.

Secondary structure, all of the multiple truss webs, has a split webbed outer skin with corrugated sheet stiffening but no inner skin. Using a compressive, this outer skin with the corrugations arranged chordwise reduces the sparweb deflection.

This arrangement allows the secondary structure to follow load deflection of the primary structure without collecting spurious loads, and avoids deflection of permanent shear webs which are characteristic of conventional skin-stiffener construction is second air structure.

Multiweb and sandwich skin construction is used in the fin and tail planes for the most weight saving and certain stability reason. But the fin has a single skin with corrugated stiffening which offers a superior load-carrying surface without incurring a weight penalty.

Prototype Tail Unit

The prototype aircraft had a tail unit of conventional fabrication. The switch to sandwich construction was made partly for production reasons. One tail fin section was not so attached to the tail fuselage which had led to the loss of the prototype.

The cause of this failure has still not been officially disclosed. Although it was generally conceded to be due to further known modifications to the tail and fin attachment included stiffening of tail and fin joints. Panels have fair-

able characteristics. Unique full-scale characterization of the wing joints have been placed in structural tests. These tests have shown that a crack virtually always starts at the wing joint in the outer skin of the sandwich where it can easily be detected. Propagation rates are very slow.

The crack location is due to the fact that the outer skin being split-skin, is stiffer than the inner skin and thus has collect more load. It is also further from the neutral axis.

Drinking the corrugated skin span wise between ribs is another full-scale feature. It limits crack propagation in overall panel width, and helps of a core shear would reduce bending strength of the wing by only 10% and use a much smaller reduction in the truss strength.

Skin Checks

Other useful features of the panel revealed in tests show that the outer skin cracks almost appear before any cracking. Cracks here would be difficult to detect. At each spot there are complete spanning panel joints.

The haulage is largely conventional with corrosion forces and strength but design is compressed for the very large bulk door exists. A number of substantial corrugated lagman are added for loading reinforcement.

Discontinuity created by the deep wing truss has structure in the fore-legs is compensated by placing the front foreleg floor, two reinforced lagman and the bottom wing ribs all in the same horizontal plane.

The rear section remains consists of the prominent cables which is attached to the haulage at four points associated with the principal fin and bottom lagman. Forward section is loaded by the cable floor, shell, and a rear support bulkhead. Equipment is contained in an adjacent compartment which is pressurized by ram air.

Republic SD-3 Drone Makes Initial Flight

Republic SD-3 combat reconnaissance drone, designed by U. S. Army Signal Corps and developed by Hughes, has completed first flight and evaluation tests. Reconnaissance drone has made four successful flights, including night launch and recovery. SD-3 has reconnaissance sensors and GWS, AGM, IR, TV for photography or infrared detection, radar or television. First weight less than 1,000 lb., 15 ft long and has wingspan of 11 ft, payload is a 140 lb. Canair rocket motor. Drone is launched from a mobile trailer by two Arrow II rocket nozzles.



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4. IRRADIATED IN ARGON The two steel cans placed in a stainless steel vessel in a furnace, heated to about 540 K (temperature 340°C). The atmosphere within both radiat. can. and vessel are purged continuously to maintain an atmosphere of 100% Argon gas.

After the heating cycle, the panel is etched in $\sim 100^\circ\text{F}$ wet CO_2 , reflected and Ripped 3 and 4 controls (in 15 min) are completed and tested—an important step in the final assembly.



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ACKNOWLEDGMENTS • The authors thank Dr. A. Pothoven for assistance in the laboratory.

[illegible]

NEW AVIATION PRODUCTS

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Model D-1800 motor operates at 28 volt d.c. and 60 amp, motor delivers 1.6 hp at 2,000 rpm. Higher output speeds to 25,000 rpm are available by changing the reduction gear box. Motor life in field use is in excess of 1,500 hr. the motor states. Ambient temperature is at 260°F ambient temperature at 60,000 ft. altitude. Motors for higher ambient temperatures, 300°F and 320-330°F altitude are available for missile applications.

Hovser Electric Co., 2380 S. Stoney Ave., Los Angeles 25, Calif.

Aircraft Coffee Cap

Drinking cup designed for use aboard aircraft utilizes spring. Plastic cap fits over spill buffer ring which deflects the liquid inward, thus reducing the chance of spillage.

Cap is designated Aero-Cap Model K1000.

Robinson Aviation Inc., Yonkers, N. Y.

Jet Oil Pressure Gauge

Aircraft oil pressure transmitter, designed for direct monitoring to jet engines, is capable of withstanding vibration to 2,000 cps. at 75 g.

Model 515 transmitter is available for ranges of 0 to 60 psi and 0 to 160 psi. Indicators available for use with the transmitter are available in sizes of 1 1/2 in. diameter, 2 in. diameter, and 2 1/2 in.



gauge. Model 14 in. diameter pressure indicator system operates at 26 or 400 psi. power. Transmitter operates at a temperature range of from -65 to +230°C and meets USAF specification MIL-T-20645. Weight of transmitter is 10 lb.

McCormick-Corbin Co., 61 Alden St., West Orange, N. J.



American's Baggage Expeditor Used on Jets

American Airlines baggage expeditor system will be used in conjunction with the fleet's Boeing 720-120 jet transport schedules. System includes six containers, each holding up to 35 bags, which are moved to the aircraft's forward compartment.



Constant Speed Drive

Differential type constant speed drive is used to combine accurate speed control, efficiency, low load rejection and reliability.

Planetary gear train is principal power vehicle and a variable duplex.



double pump motor adds or subtracts speed and power in response to a speed governor.

Input speed range of the 60 hp unit is from 3,000 to 7,000 rpm, and output speed is maintained at 6,000 rpm under varying loads. Steady state speed control is $\pm 0.01\%$ over a 20:1 oil temperature range, with efficiency to 97%. Transient response is 0.1 sec. maximum.

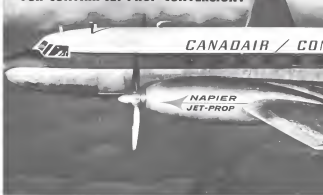
Vickers, Inc., 1400 Oakman Bl., Detroit 32, Mich.

Gas Pressure Regulator

Regulator provides tank pressure and pressure regulator in fact, pre-set status of aircraft and vessels.

Pressure regulator operates at 300+ or -3 psi, over an inlet pressure range of from 3,000 to 480 psi and a flow demand change of 140 to 140 SCFM of nitrogen. Weight of the unit is 6 lb. and maximum dimension is 6 1/2 in. Diameter is less than 3 1/2 in. Modified versions of identical size can operate at 35 to 500 psi with flow rates to 2,000 SCFM at nitrogen. Regulator operates between -65 and +233°F with helium, nitrogen, oxygen. Raytheon Motor Division, United Chemical Corp., Dennis, N. J.

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NEW NAPIER JET-PROP GIVES THE

Jet-prop power for Convairs... offers you the most direct solution to rising costs in air transportation.

30 ADDITIONAL YEARS OF PROFITABLE OPERATION

Convair, Ltd., a subsidiary of General Dynamics Corporation, now offers the jet-prop Canadair/Convair 540... in two versions. In Version A, you get a new production line aircraft powered by Napier 3500 horsepower gas turbine engines.

In Version B, your present Canadair 540s are converted to jet-prop power by replacing its piston engines with the same Napier gas turbine engines.

The economy and performance of both versions is identical.

Either version gives you the many advantages of jet-prop power. Either version offers a profitable life span as long as that of the DC-3... which began its profitable life in the early 1940s and is still going strong.

The Canadair/Convair 540 is the latest development in the world-famous Convair series of 240-340-440 airliners.

SMOKE OPERATING COSTS AND WIDER PROFIT MARGINS

When powered by Napier engines, the Canadair/Convair 540's direct operating costs drop from \$16 per hour to \$26 per hour compared with piston engines (Convair) ... with a resulting drop of 75% in break-even load factor. Hourly profits jump from \$37 to \$54... thus more than doubling the annual profit from \$86,040 to \$252,900.



based on 2700 hours utilization and an average of 33 passengers. You can depreciate your investment in a Canadair/Convair 540 as fast as five years. The additional productive capability more than pays for the cost. In addition, the increased passenger utilization of jet-prop power will automatically result in a higher average load factor.

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You can keep your Napier-powered Canadair/Convair 540 in the air longer... where your profits are made. Ground time and delays decrease. There's less need for routine inspection and minor repairs. You also require less stockpiling of spare parts along the line.



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Your Canadair/Conquest 540 now covers more distance per hour. Speed increases by 50 m.p.h. Time to cruising altitude lessens by 54%. Maximum payload range increases from 340 miles to 630 miles (with reserves). Jet-prop propulsion also allows you to carry more passengers. The Conquest 540 now has a standard capacity of 40 passengers. In the Canadair/Conquest 540 you have flexibility—from the deluxe configuration of 40 passengers to a tourist configuration with 64 seats. Therefore you can tailor your seating plan to meet your specific needs.

STRONGER PASSENGER APPEAL

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The Napier jet-prop reduces noise and vibration to a bare minimum, greatly increasing passenger comfort and satisfaction.

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A team of engine and passengers...
and by two regular blade engines



Recent production helicopter powered...
by Napier turbine gas turbine



Recent production helicopter carries...
with all passengers...
and by two regular blade engines

GE Official Details Nuclear Plane Need

Shelley The aircraft engine production...

How do we measure? I am an industrial engineer...
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Gain Understanding

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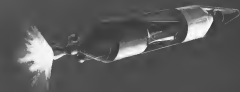
John W. Darley, Jr.

John W. Darley, Jr. has been in the nuclear energy program since 1951 and is now manager of the special nuclear section of General Electric Co.'s Aircraft Nuclear Program Department. His section is responsible for project planning and management, engine fuel analysis, policy and system plan development, engine research. Darley, 31, has an engineering degree from Cornell University and a degree from Harvard University's School of Business Administration.

John W. Darley, Jr.

John W. Darley, Jr.
The President of the United States
The White House, Washington, D. C.

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WHAT IT IS: SPACEMETAL is a stainless-steel sandwich with the light weight, high strength, and heat resistance required for Space Age missiles and planes. Inner sheet is beaded to form a V-shaped corrugation which allows rapid heat dissipation, permits hydrostatic testing for quality control. Yields weight savings (theoretical) as high as 25 percent over solid materials.

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RESISTOFLEX

MISSILE ENGINEERING

Pacific Range to Play Big Tracking Role

By Russell Ihekwe

Los Angeles—Agencies with satellite and satellite tracking capabilities are expected to merge these into a single global tracking net before the beginning of the new fiscal year in July, Pacific Missile Range officials believe.

Under the present organizational setup, projects have their own specialized tracking nets. This is becoming progressively more unworkable as projects multiply and new space and missile agencies arise.

Pacific Missile Range will be leading for a large part of the world-wide reconnaissance job with satellite and equipment as well as with tracking and intercept stations in Okla. and Hawaii.

Pacific Missile Range is engaged in the job of providing range services for all

projects launching long range missiles and satellites from the West Coast as well as the job of operating the old sea-to-sea range and inland range of Naval Missile Test Center, Pt. Mugu. Facilities which are part of Pacific Missile Range include Mugu, Naval Missile Facility Pt. Arguello, installation at San Nicolas Island 10 mi offshore and others at Midway, Wake and Eniwetok. Distant island stations are administered from an advanced base at Kaneohe Bay, Oahu. Vandalia, AFB, adjacent to Arguello, is not part of the range. It is a training base and a technical branch site of the First Ballistic Missile Division, Strategic Air Command. Live, post-fire missile shots from Vandenberg get Pacific range support upon request and are coordinated with other nets in the neighborhood by Pacific Missile Range.

The range is not expected to achieve its full growth for 15 years, and the first outfit in that line should amount to about 54 facilities, of which half would be spent in the first five years. Expenses plus satellite estimates of the sea-to-sea range from an area of 193 mi. x 219 mi. to a band 900 mi. wide and 1,500 mi. long. This would be possible in the range and put-off shore. It could not be used as an intercept area for the big ballistic missiles but would probably be useful for development and test ranges of some high long range missiles because of the ease with which instrumentation could be placed along the coast. It would also be handy for recovery of satellites. The Fiscal 1966 budget will expand the test range to an area of 260 mi. x 506 mi. from the present 193 mi. x 250 mi. dimensions.

An area of about 1,500 sq miles from the pole is a potential ICBM impact area for the range's duties and ICBM impact area are not beyond Midway, Wake and Eniwetok. Plans allow the extension of the ICBM range to impact areas over 30,000 mi. away in the Indian Ocean. Midway is a dangerous characteristic of the range's remoteness at an altitude is to be taken of the flexibility available in the concept of the range. Iceland range between Pt. Mugu and the Army's Big Bear range, proved to Utah which was used during Chance Vought Republic program was reconstructed completely with track and radar mounted gear. If it is to be used transferred elsewhere to assist in other projects. Iceland range will be replaced as about a year and a half. Long range planning calls for 12 range ships to serve the missile range and satellite projects being laid from Vandenberg and Arguello. The ships will provide tracking, intercept, control, facilities etc. They will belong to civilian operating organizations as will be maintained from Midway Sea Transport Service. Navy considers the use of fleet units for range jobs unworkable.

At present there is one range ship operating, and another is being acquired in Fiscal 1965. The one operating is USNS Fowley Joe E. Mullen. It is manned by a civil service crew of Midway Sea Transport Service and is permanently assigned to Pacific Missile Range. Instruments used in Joe E. Mullen is operated by qualified quality in Air Force-administrated Advanced Research Projects Agency contract to support the Discoverer Series-VS-117 program, sea launching, polar orbit

satellites from Vandenberg. On the Discoverer 1 launch, Joe E. Mullen was attached 900 net down range.

The new ship being requested will be a modified VC-2 variant ship. It will cost about \$1 million and will take about two years to convert it into a range ship. USS Norton Sound, the only ship now equipped to launch large rockets, is based at Naval Air Station, Alameda and is sometimes used by Pacific Missile Range as a command ship.

Pacific Missile Range is not offering present plans stage tracking because the equipment is not available and no development systems are assigned to the range which would make it necessary. Missile impact location systems (MILS) are being installed at Midway, Wake, Eniwetok and other Pacific islands as a check on accuracy. The MILS use World War II SONAR underwater sound ranging technique to locate impact. An explosive charge in the missile would be detonated at a depth of about 3,000 ft which is approximately the level of the deep sound propagation channel in the ocean. It can be heard at great distances and a comparison of time of arrival of the sound at several stations provides a fix on the point of detonation.

Pacific Missile Range has offered to supply the instrumentation for the earth-to-orbit operational satellite launching range and a new mission to determine on the proposed Launch site and most of the program would probably be run by National Aeronautics and Space Administration. No launch site has been selected as planning is by no means firm.

It would be one of a number of others or it might even be possible to launch from a ship.

It has not been definitely established that there is a need for an operational satellite launch site. There are two potential advantages to be had from operational sites. The orbit is operative so that the satellite goes over the same stations on every pass. This saves accuracy for mission satellites and sets down the number of stations needed to get continuous data.

The other advantage is that the plane of the equator allows in within 219 deg. of the plane of the ecliptic, near which all the planets of the solar system orbits are located. Therefore, major planetary orbits must almost be in the plane of the ecliptic. If the number of programs needing operational sites is small, it may give more coverage to those the performance needed, necessary to maneuver from the satellite orbit into the operational one. This could cut payload by as much as 50%.

Most of the benefit will be for satellites such as weather mapping and military



DISCOVERER 1 launching from Vandenberg AFB over the Pacific Missile Range (NW-Min. 8, p. 521) ended operational support of the range and Air Force stations that conducted the shot.

reconnaissance orbit for jobs which because they offer line of sight coverage of the entire earth cover 12 hr. Since it is the only established range from which a polar satellite can be safely launched, Pacific Missile Range will probably have an important role in the development of these satellites despite the fact that its present role on the big missile field is supposed to be training.

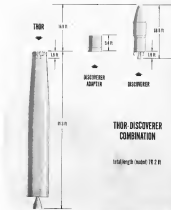
As development begins, Arguello and Mugu also offer advantages of safety and convenience since they are so far from population centers and are surrounded by ranges of hills which would isolate blast from nuclear rockets and the big 15 to 250 altitude. These characteristics are being discussed. Low between development and training shots is thus answer since high cost, except the performance needed, necessary to maneuver from the satellite orbit into the operational one. This could cut payload by as much as 50%.

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OVER-ALL LENGTH of Discoverer 1 including a modified Douglas Thor and Lockheed satellite vehicle, is 92.2 ft. Satellite was the first to be launched from Pacific Missile Range.

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All equipment complies with Mil E 16490, Mil E-4126, Mil E-4970 and other specifications as required.

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GLAN aerodynamic design streamlines this sled at Captive Missile Test Track. Sled can carry a 120 lb. payload at 5,700 mph.

Rocket Sled Achieves Mach 4.1 Speed

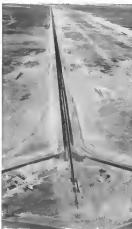
Holloman AFB—Victory of Mach 4.1 was achieved at the Air Force Missile Development Center's 15,000 ft. sled track shortly after its fiscal year tag last month (AM May 2, p. 25). Two-stage rocket-propelled unmanned sled hit a top speed of 4,530 feet per second, or 5,090 mph, in a test to

determine factors that on the sled slings as sleek the sled sails.

High-speed sled test boosted to about Mach 2 by an 8,100 lb. thrust Cygnus rocket, and to its final velocity by a cluster of four Leda rockets. Although friction between the sled and rails is considerable, it

amounts for only a small fraction of the overall drag when the sled is traveling at supersonic speeds.

Sled track was constructed for testing of missile components, human factors, vibration tests, acceleration and wind blast effects. In some cases complete missiles, such as Bock, have been given



AIRIAL view of 15,000 ft. test sled shows vehicle hitting the water brake. Triangular shaped ramp mounted below the sled floor jacked up water in the trough and threw it out on both sides and behind the sled. Here helping it to stop.

high-speed engine tests on the track prior to flight.

The Holloman track extends for 15,400 ft. over White Sands Proving Ground. The two rails were forged a half to 10 ft. wide, partly ground smooth so as to be smooth along their entire length. To prevent buckling at high temperatures, rails were stretched in columns prior to that they are under constant tension at temperature below 1200° F. Total drag due to the rails is 23.5 ft. at a temperature variation of one to 100° F.

Profile of track shows a run of only one foot per thousand feet of length. Topography of the area is such that the track can be extended for an additional 95,000 ft.

Accelerations up to 10g are possible and decelerations up to 17g can be achieved through a waterbrake system. Variation in deceleration can be controlled by changing the depth of the water brake and slowing the sled.

Water level is maintained by floatgates down which bleed in the same amount of water. The sled's velocity is then reported by the water, resulting in deceleration.

Forecasted decelerations have been accurate to within 75. "Accuracy will" shows up by the water brake makes the sled resemble a desert home Gold Chip race.

According to Holloman officials one of sled track facilities will result in considerable saving in testing of missile components. "They normally not recoverable after a single test flight can be subjected to an environmental analysis to actual flight conditions and recovered for reuse."

Following is a list of subcontracted contracts for \$25,000 and over awarded by Air Force Contracting and Research, Development and Test Agency, AFMRC, at the Air Force Missile Development Center, Holloman AFB, N. M., assigned to various services, project 15-4300-1, 15-4300-2, 15-4300-3.

General Electric Corp., Pasadena, Calif., 15-4300-1, 15-4300-2, 15-4300-3.

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USS SARGENT (DD-337) forms a bridge hog (dead) pattern in ASW operations off Key West, Fla. USS Epperson is in background.

Fund Limit Sets Pace for ASW Progress

By Carol Sawelson

Washington-Navy needs better and more search forces plus a major breakthrough in detection technologies if it is to counter effectively the threat of Soviet missile-bearing nuclear submarines. At the moment, prospects for the fleet appear dim at best, and the trouble for the service appears largely dependent upon the availability of funds and effort.

Rear Adm. Charles E. Winkley, vice submarine warfare and naval operations in the Office of the Chief of Naval Operations, told a group attending a recent anti-submarine warfare symposium here that the time needed to achieve the necessary breakthrough

would largely "depend upon the budget."

Funds presently allocated by the Administration for ASW in the Fiscal 1966 defense budget fall slightly below those provided in Fiscal 1959 when Congress appropriated \$44 million above the original requests in an effort to accelerate research and development programs.

Fiscal 1965 research and development funds, Adm. Winkley said, will equate at approximately the same level as those of Fiscal 1959, including the supplemental appropriations, but requests for shipbuilding funds set below those of the previous year. Winkley added, however, that "once we find the necessary means of achiev-

ing a breakthrough, we'll get the money."

Vice Adm. Robert B. Price, deputy chief of naval operations for the Navy, said the Fiscal 1966 request for ASW research and development funds represents a "reasonable amount of the national budget... it's substantial."

Earlier, in referring to the overall ASW budget in an aside from his prepared speech at the symposium, Adm. Price said: "Most of us wonder if we are spending a commensurate amount of the national program on the vital problem of submersible warfare."

Other developments at the symposium, sponsored by the Navy League in an effort to emphasize Navy's need for better ASW weapons and techniques, included:

• U.S. now has no adequate defense against the nuclear, missile-launching submarine. Vice Adm. William G. Cowart, commander of the Atlantic Fleet's Anti-Submarine Defense Force, said: "...our opponent, the submarine, is going through a period of dramatic development. ASW is trying to catch up. It is the old story of the offshore weapon getting a head start."

• Major breakthrough in detection has become imperative in view of decreasing U.S. forces plus the increased Soviet potential for launching air-launching or ballistic missiles from submarines well at sea. Adm. Price said the Navy needs a system that will permit detection "from an area from 50 to 75 mi. from the acoustic to a depth of 1,500 ft. This would permit us to effectively deny the ocean against any class submarine."

• Soviet, whose tempo has been extended by a factor of three since World

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because of their experience with this particular alloy. The René 41* they supplied us proved to be exceptionally clean and was more easily formed and welded. We soon were meeting production schedules."

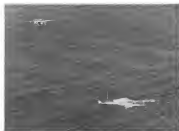
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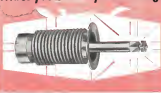


GREENMAN 527 Tracker makes run on USS Barber during ASW training.

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Way II, offers the best immediate potential for acquiring additional wings through sophistication of present means. Source responsibility, however, is limited by Soviet doctrine as it strikes the inspection chain of the US and by its limited capability for dissemination.

•Non-acoustic system, provide some form of long range electromagnetic detection, probably will provide the best language answer. Strategic Carbon Division of General Dynamics Corp. says has a trade contract with the Office of Naval Research for development of such a technique.

•Industry interest in anti-submarine warfare has shown a marked increase during the past year, with a number of companies marketing their own funds to research and development projects in an effort to fill the Navy budget gap and improve the state of the art. The official response has been noted that in an unprecedented posture, industry is putting its own money into elaborate search programs to develop the necessary equipment for an adequate anti-submarine force.

•Soviet submarine constantly has been made by Navy forces all the Atlantic coast recently saw the U.S. awarded, but never within the five-mile limit, despite conflicting reports to the contrary. Navy sees its "positive identification" of Soviet submarines has been made in this area since, under Navy technology, "positive identification" reports in actual visual observation of a surfaced vessel. Soviet submarines, consequently, apparently have orders to remain submerged at all costs while operating near the U.S. coast.

Options are divided among the top Navy officials attending the symposium in the concept Soviet attack capabilities and the probable length of time before Russian attack power will be sufficient to make this appearance in operational service. There was general agreement with Adm. Cooper, commander, that the "submarine attack threat is coming and it's coming fast."

Adm. Cooper added that "we give the Soviet credit for having experimental as-built testing, learning submarines but we don't believe they have any operating fleet yet." "We think they could build up an operational force relatively fast."

Adm. Jewell Wright, commander of the U.S. Atlantic Fleet, stressed the submarine threat, "Concentrated in importance, though not yet in size, to that from the air. I don't know how many more submarines they have... but I assume that they do have them." He later added that there is "evidence" that the Soviets are concentrating on new types of submarines and this explains the decline in the number

of Russian submarines at sea from 450 last June to 450 at present. "We have strong and reasonably well established evidence that they are developing more submarine, possibly as far as they can, but we own belief is that they are not working on Polaris-type submarines."

Capt. Richard B. Lanning, former commander of the nuclear submarine Scorpion and now attached to the Office of the Chief of Naval Operations, pointed to the Soviet emphasis, in production of conventional submarines, and added that, if the goal for seven years development and production cycle is followed, "no impact, possibly adverse, submarine might come up into production."

Without their recent capabilities, the potential strategic threat of nuclear submarines to the U.S. industrial and military complex, coupled with their traditional threat threat against shipping, has made anti-submarine warfare the top priority concern of the U.S. Atlantic Fleet and the NATO allies.

Industry's accelerated interest in the problem resulted in providing an effective ASW defense from high seas has been public recognition for the first time of its long-standing role of effective anti-submarine detection and classification techniques.

Adm. Wright told a symposium group that "many companies have been

New ASW Center

Washington—U.S.-financed Anti-Submarine Warfare Evaluation Center will be formally opened at Ft. Spena, Italy, within the next few weeks to seek out of available European scientific and engineering talent in the effort to find an effective ASW doctrine and classification techniques. Capt. John N. K. O'Connell, commander of the ASW Center, said the ASW Center will operate as a liaison center to that of the As Research and Development Command's Research office in Rome (AW June 9, 1968 p. 21).

putting their own funds into ASW research since the problem is systemic has been made known by Navy."

As an example, he said one partner for company which he said "has been in a real contact for years." Now, he added, it has had 75 of its finest minds working on anti-submarine warfare for the last two months.

One contractor industry move cited by officials at the symposium was the establishment of an Anti-Submarine Warfare Committee by the National Security Council. Adm. Wright said the committee is now operating approximately 50 companies and focused in an effort to determine how Navy can best be helped in solving its problems. Member companies include Chance Vought, Douglas, Grumman, Lockheed,

Boeing, Martin, Goodyear Aircraft, General Dynamics, Hughes Tool Co., Radio Corp. of America and Western Electric.

Lack of adequate forces to cope with the Soviet submarine fleet, with its double threat in a strategic and tactical respect was mentioned by Adm. Cooper, whose Atlantic command now has three special ASW task forces—1st, 2nd and 3rd—each with its own assignment of growth during the problem at hand, present and future equipment needs and tactics to make best possible use of available assets.

At present, there are no such forces in the Pacific Fleet. "The Pacific Fleet," one top official said, "has been a little slow in catching up to the problem over most of the Atlantic. I think that to get the point now though, and they're moving along pretty fast."

The need for large, mobile anti-submarine warfare ships was also stressed by Adm. Wright, who termed ASW a "national problem" as well as a "Navy problem" and said "could we not ship the equipment required by the submarine (by using effective means of detection) the problem is manageable only by relatively large forces involving expensive and complicated equipment and highly trained men."

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SEE system, developed by Sperry Gyroscope Co., enhances radar echoes by means of traveling wave tube amplifiers. Plans of four shows X-band system consisting of tube, power supply, transmitting and receiving antennas, and test equipment. X-band and L-band antenna systems are shown at right. X-band receiving antenna is concentric type; transmitting antenna is open-end waveguide. L-band system employs broadband dipoles.

Radar Echo Enhancer Simulates Bombers

By James A. Fines

Great Neck, N. Y.—Diversions aimed at targets for Soviet nuclear force could lead to the Atlantic Missile Test Range, Cape Canaveral, Fla., are being made to appear as radar targets surging in size from the southeast fighter to the largest Soviet intercontinental bomber.

The deception is achieved by means of a radar echo enhancing system called SEE, developed by the Aerospace Corporation Division of the Sperry Gyroscope Co.

SEE, standing for Sperry Echo Enhancer, is a microwave traveling wave tube radar replica system that simulates the function of a radar beacon. The difference, however, is that the power of the transmitted signal is proportional to the power of the received signal over the normal operating range of the traveling wave tube. When the gain of the system is set to provide a return signal equivalent to the radar echo from a target of specific size, the augmented radar echo appears proportional to the desired target size at the target range in range from the radar.

In addition to target class applications, Sperry anticipates use of the SEE system for training of air defense personnel, radar calibration, and civil air traffic control. The system is not expected to compete with the ATC because for use in commercial aircraft but,

because of its desired simplicity and low cost, the company expects it to find use in business type aircraft.

Development of the system began late in 1956, with feasibility testing being done in 1957, under company funds. Slightly differing systems have been designed to operate at L-band, S-band and C-band.

Use of the system at Cape Canaveral began with test flights conducted there last fall.

Sperry engineers say that the L-band system being flown at the Cape has been operated successfully under actual conditions simultaneously in X10 and G-50 devices, and North American F-100 aircraft at altitudes above 15,000 ft. and speeds approaching Mach 1. The equipment has operated reliably without preannouncement or check warning.

Resembles ECM Equipment

The SEE system closely resembles electronic countermeasures equipment using traveling wave tubes to receive and retransmit radio signals. Such countermeasures equipment, however, is more complex and more expensive, because the received signal must be processed before retransmission in some manner that will confuse or deceive the enemy.

The traveling wave tube of the SEE system functions only as a microwave

amplifier, but the tubes that are being used by Sperry were originally developed by the company for countermeasures applications.

The SEE system consists of a family of three microwave amplifier devices which replace the simplicity, reliability and economy of traveling wave tubes to amplify but substantially simulate radar target size as a function that provides only adjustable gain characteristics. The system was developed to fill the need for providing direct target size to reception system calibration and training, in that small expendable devices could be made to enhance receiver system radar, operation and results as if these devices were actually larger (on a specific type of range) aircraft.

Radar target augmentation increases the level of the received radar echo signal from the target by artificial means. Specifically, the outgoing energy density must be increased on reception. This can be done either by energy focusing at wide positive deflection at the expense of angular coverage or by adding more energy in the case of an active beam amplifier where almost any desired spatial coverage can be obtained by suitable antenna design.

Additionally, to obtain a constant area-echo, a constant effective radar cross section—the ratio of the input and output power density must be constant

with changes in radar range. This defines the radar target cross section parameter of the simulated radar target system.

For a reflective disc reflector a constant area surface, like an amplifier it varies its constant system gain. A frequency because an exponential correlation, where power output is constant for any signal level above a certain minimum, cannot simulate a constant echo area at varying radar ranges.

The traveling wave tube of the SEE system basically is a very wide band microwave amplifier to which has been added an adjustable gain characteristic by a definite dynamic range of the input signal level. This level ranges from the input noise level to that required for output power saturation. The receiving system complement is a power supply and an input-output antenna system providing the desired spatial coverage.

Operational Features

The operational features claimed for the SEE system of radar augmentation are:

- True area simulation as a function of set system gain
- Adjustable area simulation in level and spatial distribution through attenuation and antennas
- Relative operation for reactive multi-target operation (Microscopic operation in which the target echo received by the receiving system is proportional to the simulated target area) in bistatic operation, the target echo received by a receiver using sensitive listening—such as the Beacon—can be proportional to the simulated target area.
- Simultaneous multiple frequency operation
- Useful attitude control by radio command or manual radio operation.

The attenuating power built at the traveling wave tube determines the level of false operation and therefore the level of true area simulation. In practice, this attenuation level is matched to the level at which the radar receiver gain control becomes non-linear (saturation or signal limiting begins). For this reason, the system operates in a region between saturation and non-linearity of the radar receiver, where the signal and the receiver noise levels are competing. These non-linear radar system effects usually cause rise in operating signal-to-noise levels of about 7 dB.

One disadvantage of conventional radar becomes the fact that it cannot be simulated by the SEE system—due to double target return. This means where the air returns from the aircraft are strong enough to appear on the radar's plan position indicator with the flight deck level because returns delay between



Pioneer IV Tracked by GE

Signal from the Army's Pioneer IV solid rocket was tracked by a detector at 410,000 mi by General Electric engineers who mounted a parametric amplifier at the test point of an F-105 prototype. Amplifier employs a theta mode with a 1.5 inch square aperture at L-band with 100 lb. bandwidth. Power frequency is X-band. Parabolic (above) has aperture nearly 50 ft. in diameter. System is shown being checked before. System is operated by equipment from GE's Heavy Military Dept. and General Engineering Laboratory.



MAY 4 OFFICIAL AIR TRANSPORT FACTS AND FIGURES

Once again, AVIATION WEEK has been officially designated

to publish "Air Transport Facts and Figures" as compiled by the Air Transport Association. These official operating statistics will detail the impressive picture of air transport progress witnessed in 1956. In addition, AVIATION WEEK editors will devote extensive editorial coverage to the most significant areas of current air transport development. Included will be a special report on commercial jet operations as experienced by Pan American with the Boeing 707 and Eastern and American airlines with the Electra.

This is your annual opportunity to speak to the largest audience of decision makers in air transport when their ears are at a peak. It will gain the attention of manufacturers of commercial air transports, members of Congress, airline CAA and CAB officials. If your business is equipment, materials or services for air transportation, this is one issue to schedule today. Regular advertising rates apply.

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Current issue average paid — \$3,000



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Aviation Week
Inside Space Technology

actual and achievement of the requested return with the SEE action is sufficiently small, Sperry engineers say, so that the two others are superfluous.

Production of SEE system by Sperry to date has been more intricate. Light Limited system having gone to Boeing Aerospace Co. for the Boeing test program at Cape Canaveral and use X-band system in Boca Raton, Fla. Co. for study as to use with the Rome Air Force. Additional Light Limited system will be produced by the Air Force for use at the Eglin Air Force Base in cooperation with testing of the new, long range DM-93B Boeing missile.

One of the reasons for the increasing interest in active radar repeating system, according to Sperry, is the belief that passive reflector cannot provide the extra augmentation required—often because of limited angular coverage, because of the size required for use with lower frequency radars, and because active can be used for more.

Other companies that are believed to be active in this type of work are the International Telephone & Telegraph Laboratories and Texas Aircraft Corp. ITAT Laboratories holds contracts both with Ryan and Radioplane.

TESTED FILTER CENTER 32222

• **Coarse Computer Feed-Back**—Of a coarse control computer in a Boeing B-52, instead of required coarse view and display, improved feed computer efficiency sufficient to permit a 9,000 lb. increase in airplane gross weight, correct flight data indicate. The 9 lb. coarse control computer was designed by John Gentry Manufacturing Co. from original development by Massachusetts Institute of Technology. The computer can act as the Coarse B-52 Program was sponsored by Wright Air Development Center's Flight Control Laboratory.

• **Selective Calling Evaluation**—Comparative flight evaluation of eight different types of an ground selective calling system currently is under way at Wright Air Development Center's Communications and Navigation Laboratory. Following tests, the laboratory will draw up specifications for selective calling system incorporating best features of each type for subsequent development. System must be suitable for use in high frequency and ultra high frequency bands, both single and double sideband type operation.

• **Signal on Dotted Line**—Major contract award recently announced by a major communications institute.

• **International Business Machines Corp.**, Natick, Products Division, will provide ultra-high speed digital computer to International Telephone & Telegraph Corp. for use in Strategic Air Command Control System which later is building for Air Force.

• **Thompson-Rae-Woodbridge Products Co.** has received order for rental of its RW-900 digital computer for use of the Federal Aviation Agency. Computer will be used in simulation and studies of traffic control problems in FAA's Bureau of Research and Development in Atlantic City facility.

• **Shred Engineering Inc.**, 5508 50th Street, Tulsa, Okla., Signal Supply Agency for AN/PUS-13 Search Locating System which will be used to detect and locate atmospheric disturbances at long range to warn of formation of most weather conditions.

• **Huffman Electronics Corp.**, 513 Rockwell Street, New Branch of Anemometer for calibration and comparison at 4,800 AN/AP-71 anemometer, Great Falls.

• **Perkins Instruments Inc.**, 5215 90th Street, Irving, N.Y., for high-speed analog computer to be used in simulation of dynamic model interactions.

• **Selwyn Electric Products Inc.**, four contracts totaling more than \$5 million, from Signal Corps for development and production of direct, additional MGR-10C transportable digital computers.

• **Calvert Electronics Division**, The Calvert Co., Needham Heights, Mass., \$218,000 from Navy Bureau of Naval Weapons, for production of ruggedized version of high gain monolithic UHF down converted receiver, AU 751/U.



Eight-Element Helices Recovered Pioneer IV Data
Tracking and telemetry signals from Pioneer IV, the Army's latest probe into the Moon, were received for the first day by General Electric's space vehicle tracking station near Schenectady, N. Y. Antenna for the facility is made up of eight helices which feed double sideband, high frequency antennas. Facility is operated by engineers from GE's Space Engineering Laboratory and Honey-Melroy Dept.

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Group Instruments Inc., Dallas, Tex. 75241

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B-26 CONVERTED its executive use by R. G. LeTourneau, Inc. Note in front view (inset) steel roof that has been installed in the cockpit hatch cover to protect the pilot. The conversion has a narrow cabin window under the wing (see side view) and a square window aft of the wing, which also serves as its cockpit hatch.

LeTourneau to Offer B-26 Conversion

By Craig Lewis

Longview, Texas—R. G. LeTourneau, Inc. needs a growing degree capability in the field of commercial aircraft overhaul and service, like at LeTourneau Air Center for offering business conversions in executive versions of the Douglas B-26.

LeTourneau's B-26 conversion is based on its own extensive operation of the World War II bomber as an executive transport. Company has converted three aircraft and still has two of those to service. LeTourneau advertises in the U. S., as well as in West Africa and South America.

This conversion program is part of a growing business activity operated by a company that is basically a manufacturer of heavy equipment for construction, petroleum, logging and other

industries. LeTourneau's first line operation here has developed gradually from the shops set up to service the company's executive vehicles, and it now does a wide variety of overhaul, maintenance and service jobs.

Weight Removal

LeTourneau's B-26 conversion program involves so many structural changes in the military version. It is largely confined to removing armor and other installed features, weight and refining the base airplane into a passenger configuration. LeTourneau's B-26 retains the large rear wing spar of the military version.

After conversion, the B-26 has an empty weight of 22,000 lb. and a gross weight of 37,000 lb., providing a 11,000 lb. useful load. Maximum speed is 430 mph and cruise speed is 315

mph, with the Pratt & Whitney R3360-75 engines and Hamilton Standard propellers which are standard on the B-26. Stall speed is 105 mph.

Absolute ceiling is 30,000 ft. and service ceiling is 25,000 ft. Normal flight cruise at altitudes lower than that, but LeTourneau needs the capability in its own operations in order to fly over the Andes in South America. Since the result is not pressurized, oxygen masks are provided at each seat.

The company operates two different versions of its executive B-26. The long range version can fly 3,000 mi. with a 45 min. reserve, and the medium range airplane has a range of 2,100 mi. with a one hour reserve. Fuel capacity of the military B-26 has been increased by adding tanks in the wings. Medium range version carries 1,310 gal. and the longer range airplane, with

a tank in the fuselage center section, carries 1,700 gal.

Attention may be drawn to the airplane's wings. All of the wing spar, the cabin is 18 ft. 4 in. long, 42 in. wide and 64 in. high. There are two seats across the back and two seats along one side. Each of these two side seats can be folded out to make a three-person couch in a lounge configuration. With no fuel tank in the wing center section of the medium range version, space is available for a two-person couch forward of the rear wing spar.

Since the B-26 is a high wing airplane, the rear wing spar cuts directly through the fuselage and splits the fuselage area available for cabin use. LeTourneau has decided to accept this space penalty in order to retain the strength originally designed into the wing structure.

A passenger rest is also available in the cockpit forward of the wing. Both of the two LeTourneau aircraft retain the single pilot cockpit configuration of the military version, although the company expects to install a captain's seat in a future version. Very little mechanical change has been made in the cockpit area, although the base control, electrical and other systems have been covered with sophisticated painting. B-26 can be equipped with radio if a customer wants it.

Cabin Seats

The cabin is entered through a hydraulic ram door which is in the fuselage area under the wing providing access to both the passenger cabin and the forward cockpit. The cockpit can also be entered through hatches which have the top and sides. Insulated metal roof has been installed in the cockpit hatches to protect the pilot.

In converting the military version, LeTourneau cuts out unnecessary weight, lowers the floor in the old hatches and sets in a 10 degree cabin bed room and moves the rear bulkhead back about 18 in. to increase cabin length. The fuselage is completely reinforced, and fuselage strength is maintained by increasing skin gage where changes have been made in the military structure, according to W. E. Ahern, manager of the aviation division. Two windows are installed in each side, with the rear window window also serving as an escape hatch.

Baggage is carried in a two compartment and in a compartment aft of the passenger cabin. Air conditioning system is aft of the rear baggage compartment. Since cabin air is difficult to control at B-26 speeds, the LeTourneau airplane is cooled and heated completely by blowers, and there is no attempt to the fuselage.

Cost of the converted B-26 can range



COCKPIT in the LeTourneau B-26 has the original single pilot configuration, but LeTourneau expects to install a cockpit station in future conversions.



REAR BAGGAGE compartment (left) is behind the aft cabin bulkhead. Air conditioning system is behind the baggage compartment. Baggage capacity is also provided in this new compartment at right.



REAR WING SPAR carry through doors have covered by wood paneling, ribs side ribs upon, but LeTourneau accepts the penalty in order to retain the strength originally designed into the wing structure.

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HYDRAULIC stick latch sticks into the handle under the wing control surface.

from \$125,000 to \$250,000 or more, depending on the material and equipment needed. This cost is in addition to the price of the military B-26, but an adequate supply of the aircraft is expected available for \$2,000 to \$4,000. The conversion job will take a man more of 60 days.

LeTourneau has two military B-26s available for conversion now. The man, will take an order for a new conversion as well as use of its own assets, probably for about \$175,000, and start work on a new aircraft for its own use. William E. Tine, LeTourneau aviation administrator, says the company, in discussing conversions with several interested prospects and has not decided to offer the program generally to the private aircraft market.

Aviation Activity

LeTourneau launched its aviation activity in 1945 when the company started using Waco biplanes for rental for transport. Various aircraft have been used since then and LeTourneau has developed its own capabilities for rebuilding and modifying them.

The first B-26 was converted just after World War II and LeTourneau operated the aircraft for three years to replace its capabilities before leaving the military. The original conversion costed a few years ago as a "tailoff" accident, but two others B-26s have been converted and are now in use by the company. Most of the work done by the original job is still working of LeTourneau Air Center.

Through the years, the company has established an aviation overhaul facility, and does its own metal forming and painting. LeTourneau also has a radio shop and an upholstery shop, and the various B-26 conversions will be done here. Lack of an aviation shop makes instrument work, the only aspect of aircraft overhaul, more tedious and stress that is relieved by an outside firm.

An engine overhaul shop has been developed, and LeTourneau overhaul

the B-26s from the B-26s, as well as several smaller engines. Company has an engine test cell adjacent to its overhaul shop. Bids have been entered on most government engine overhaul contracts, and the award of a contract would mean an expansion program for the air center layout.

LeTourneau has been gradually moving into commercial aviation as a fixed base operator for the past year and a half. New company is looking at setting up an aviation sales organization, although no fixed bases has been reached. Along with the overhaul, modification and service work, a charter service is operated with Cessna 171, Beech Bonanza, Lockheed 12 and Piper Apache aircraft, and a Lockheed Lodestar will join the fleet later this year.

Another company activity, the LeTourneau Technical Institute, is now training out ABE mechanics and is starting a flight school.

PRIVATE LINES

First of three North 1,135° Twin-Bonanza, featuring an enlarged fuselage having conventional service entrance door behind the left wing, has been turned over to U. S. Army for conversion at Ft. Rucker. Third unit is expected to be delivered early in March.

Withdrawal of the American Association of Airport Executives from the General Aviation Council. American General Aviation Facilities Council was made official by AAE's board in a letter to the council, stating that the airport executives group felt that two in organization deals with scheduled airlines industry and military as well as general aviation, it should be in a position to deal directly and independently with FAA and other agencies.

Southwest Airplane Co. completed its parts distribution system and completed operations with opening of new offices in Houston, Texas, and St. Louis, Mo. Distribution now is split in two regions. Kansas City office is headquarters for the southern region including Denver as well as the new office at Lambert Field, St. Louis. New operation at Houston Municipal Airport is included in the southwest region with headquarters in Dallas.

Supplemental type certificate has been granted Feltus Cameron's Co.'s modification of a Cessna 170A and 170B to 145 hp. Lycoming O-435-C engine and thrust controllable propeller. Field installation kits of the conversion have been developed by the Southbay, Conn., company.



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Wisconsin Bank Buys, Operates Bell 47J



HA 47J bought by First Wisconsin National Bank of Milwaukee is piloted by Robert Roth.

It. Worth—First Wisconsin National Bank has bought a helicopter for emergency transportation of personnel, and is now using it. The bank, he added, soon may use it for other emergency services, such as carrying mail to outlying branches.

Bell Model 47J flew over from the Bell helicopter plant north of Seattle by First Wisconsin National Bank's pilot Robert A. Roth in the bank's first mission into the aviation field, and Roth said it is the first commercial helicopter to be operated in Wisconsin.

Personnel came for buying the Bell machine was to forward efficient transportation for First Wisconsin customers in the territory served by the bank and to do other financial chores, such as carrying mail to outlying branches.

Public relations expert on customers is another factor, and the helicopter may be used occasionally in such public affairs as helping the police control traffic jams.

Executive Transport

A bank spokesman and the Bell 47J will be primarily utilized for executive transport of first. Later use may involve a check clearing service for the bank's five member banks and correspondent banks, but firm plans for this service have not been made.

The helicopter, he said, will be used

for "emergency banking services," involving transportation of personnel, and is now using it. The bank, he added, soon may use it for other emergency services, such as carrying mail to outlying branches.

At times, other banks develop an expected need for both of a certain de-



PILOT Roth was hired by the bank to set up an aviation department and to fly the 1959 model Bell Ranger.

nominator, and the First Wisconsin will be able to supply them quickly with the helicopter.

Most of the bank's assets are within a 750 mi. radius of Milwaukee, although some are more than 500 mi. away. With these distances, the bank can use the added range on the 1959 model 47J it bought. First Wisconsin machine was the first to be delivered with the larger tanks Bell has added in its option to carry up to about 40% fuel. Double fuel supply is 47.5 gal. New model also has dual blades.

When the bank was investigating the use of business aircraft, it decided the helicopter was the answer to its needs because its relatively limited service area didn't require the speed of a fixed wing aircraft and because a lack of airports in certain areas makes the helicopter more practical. When the decision was made, the bank hired Roth, who has flown for Chicago Helicopters Airways and Helicopter Delta, to set up an aviation department and fly the Bell machine.

First Wisconsin executives still have to set up an aviation department as well as in the various communities served. Some emergency work will be needed to develop a helicopter system in the area, but Roth said Milwaukee and state authorities are interested and "open to help."

In Milwaukee, the helicopter will appear from a helicopter site right beside the bank. There is no airport in the city but the bank is thinking of building one. The downtown site is possible, as the downtown area is not as big, as a helicopter will be hard, and Roth expects to establish a Bell service station in a vicinity of new helicopter operations that may come into the area. Meanwhile, Roth will be the primary maintenance on the bank machine and will train it at Timonium Field.

Pressurization Mod Developed for B-26

Pressurization modification for Douglas B-26 candidate plane has been developed by Lockheed Aircraft Service, Inc. Program includes redesigning and strengthening the fuselage, adding an air inlet door, piston-driven, lightweight nose, wingtip tanks and other internal modifications. Provides empty weight of 14,927 lb., empty weight of 25,600 lb. and disposable load of 18,938 lb. With Pratt & Whitney J4330 engines of 2,480 hp, pressurized B-26 will have a cruise speed of 375 mph and maximum range of 1,199 stat. mi.

WHO'S WHERE

(Continued from page 23)

Honors and Elections

Dr. Alvin Landau, a senior project on grant at the Air Research and Development Command's Wright Air Development Center, has been named a recipient of the Arthur S. Flemming Award presented annually to young men in the federal service in recognition of outstanding accomplishments, achievement, or distinctive work.

Also named recipients of the Flemming Award are Wilson A. Moore, an Air Force research technologist in AFOSI's Wright Air Development Center, and Douglas J. Wilson, head of the Undersecretary Defense Department of the U.S. Naval Defense Test Station, Pensacola, Fla. C. N. Jones, president of the Air Force Plans Area, has been appointed to the National Aeronautics and Space Administration's Committee on Aircraft Operating Policies and the Long Range Planning Committee of the Radio Technical Commission for Aeronautics.

Changes

Dr. Robert E. Robinson, director of all medical space grants, Space Chapter team of America, Los Angeles, Calif. Long Beach Division, Douglas Aircraft Company, Inc., Long Beach, Calif., has assumed the following responsibilities: Louis T. Yui for military transport, and John Ryan for medical research, medical and support systems.

Edgar E. Byrnes, director of engineering, Calhoun and Trans-Atlantic Airways, General Division of General Dynamics Corp., San Diego, Calif. William E. Jones, executive M. Byrnes as chief supervisor, Dept. Division, and Richard P. White as chief of the Air Force medical support of the division.

Benjamin David, director of engineering and Philip A. Henning, chief engineer, Semco Company Co., Santa Monica, Calif. Harry E. Wynn, general manager, Semco, established Mobile and Senior Sales Division, Radio Corporation of America, Northridge, N. J. Arthur M. Corbin, as chief of the West Coast department of the Mobile and Senior Sales Division, Los Angeles, Calif.

Dr. George D. Smith, director of space life support systems, The Martin Co., Santa Monica, Calif. E. D. Guggenheim, chief engineer, Vought Co., Inc., East Aurora, N. Y.

W. H. Ingers, corporate engineering and planning representative at Northridge, Calif. for North American Aviation, Inc., Los Angeles, Calif.

Harold E. Brown, marketing manager, Aircraft Instrument Product Service, Instrument Department, General Electric Co., West Lynn, Mass.

William A. Inghis, chief advanced operations research expert, California Division Lockheed Aircraft Corp., Burbank, Calif. S. Paul Schindler, chief research engineer, research and development, Research Department, The W. L. Morse Corp.,



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CAPITAL TIE-UP

New York, N.Y. Also appointed to the Research and Development Division is capable staff. Success Factors, to lead optimum and performance design programs/techniques.

Stanley C. Deane, chief engineer, Air Craft & Missile Division, General Motors Corp., a division of U.S. Industries Inc., Chicago, Ill.

Dr. William R. Schar, manager, Space Sciences Division, Sperry Rand Corp., South Norwalk, Conn.

J. R. Cross, manager of administration, North Rockwell Plant, Aerojet General Corp., Azusa, Calif. J. R. Cross is currently in the U.S. Air Force as a member of the engineering staff.

Robert T. Harding, assistant chief engineer, Product Design Department, Aero Division, American Rockwell Corp., Downers Grove, Ill.

Dr. Arthur C. Gilbert, assistant project director, AUM-100, Air Weather Service, Program, Research, and Development, U.S. Navy, Naval Air Station, Jacksonville, Fla.

Andrew Johnson, assistant lead, Weapons Division, Design Department, General Electric Aircraft Laboratory, Buffalo, N.Y.

Edith McCullough, Inc., San Carlos, Calif. has announced the following appointments:

John E. Shaw, manager, research and development, North American Aviation, Inc., Columbus, Ohio.

William H. McKinley, manager, design and development, North American Aviation, Inc., Columbus, Ohio.

George M. W. Rogers, manager, research and development, North American Aviation, Inc., Columbus, Ohio.

D. M. McDonald, director of research and development, North American Aviation, Inc., Columbus, Ohio.

Robert W. Fournier, manager of research and development, North American Aviation, Inc., Columbus, Ohio.

William J. Brown, director of design and development, North American Aviation, Inc., Columbus, Ohio.

John M. Kline, manager, research and development, North American Aviation, Inc., Columbus, Ohio.

Robert W. Fournier, manager of research and development, North American Aviation, Inc., Columbus, Ohio.

William J. Brown, director of design and development, North American Aviation, Inc., Columbus, Ohio.

John M. Kline, manager, research and development, North American Aviation, Inc., Columbus, Ohio.

Robert W. Fournier, manager of research and development, North American Aviation, Inc., Columbus, Ohio.

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For Electrical Engineers: With 3 to 5 years experience in electrical systems, you will be responsible for the design and development of electrical systems. You will be responsible for the design and development of electrical systems. You will be responsible for the design and development of electrical systems.

For Industrial Engineers: With 3 to 5 years experience in industrial engineering, you will be responsible for the design and development of industrial systems. You will be responsible for the design and development of industrial systems. You will be responsible for the design and development of industrial systems.

For Chemical Engineers: With 3 to 5 years experience in chemical engineering, you will be responsible for the design and development of chemical systems. You will be responsible for the design and development of chemical systems. You will be responsible for the design and development of chemical systems.

For Civil Engineers: With 3 to 5 years experience in civil engineering, you will be responsible for the design and development of civil systems. You will be responsible for the design and development of civil systems. You will be responsible for the design and development of civil systems.

For Environmental Engineers: With 3 to 5 years experience in environmental engineering, you will be responsible for the design and development of environmental systems. You will be responsible for the design and development of environmental systems. You will be responsible for the design and development of environmental systems.

For Materials Engineers: With 3 to 5 years experience in materials engineering, you will be responsible for the design and development of materials systems. You will be responsible for the design and development of materials systems. You will be responsible for the design and development of materials systems.

For Nuclear Engineers: With 3 to 5 years experience in nuclear engineering, you will be responsible for the design and development of nuclear systems. You will be responsible for the design and development of nuclear systems. You will be responsible for the design and development of nuclear systems.

For Aerospace Engineers: With 3 to 5 years experience in aerospace engineering, you will be responsible for the design and development of aerospace systems. You will be responsible for the design and development of aerospace systems. You will be responsible for the design and development of aerospace systems.

For Marine Engineers: With 3 to 5 years experience in marine engineering, you will be responsible for the design and development of marine systems. You will be responsible for the design and development of marine systems. You will be responsible for the design and development of marine systems.

For Mining Engineers: With 3 to 5 years experience in mining engineering, you will be responsible for the design and development of mining systems. You will be responsible for the design and development of mining systems. You will be responsible for the design and development of mining systems.



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 B.S., M.S., or Ph.D. in Engineering or Mathematical Engineering, Physics, or Mathematics—rank proven ability to assume a high degree of technical responsibility in your chosen field.

GENERAL DESCRIPTIONS OF SOME ASSIGNMENTS:

INERTIAL GUIDANCE ENGINEER to assume broad project leadership in the planning and coordinating of development projects. Develop relationships of all inertial equipment with bombing and navigation computers. Must have experience in servo mechanisms, auto-compass or similar devices.

COMPUTER ENGINEER to perform physical mathematical analyses for solving complex control problems by use of digital computers. Applications in missile systems and special purpose computer systems such as OGA plus extensive experience in computer analysis.

RADAR ENGINEER to analyze ultimate limits and present techniques and to develop new concepts promising topographical sensors for subsonic airborne and space systems. Develop sub-sonic radar pulse, waveform and detection circuitry. Analyze doppler radar systems to determine theoretical sensitivity and performance limitations. Experience with transmitter circuits and radar test equipment is highly desirable.

TRANSDUCER ENGINEER to design transducer amplifiers, delay lines, transducer tube conversion circuits and develop specifications for transducer equipment.

ENGINEERING PHYSICIST to assist in design and development of advanced solid state computers. Must have extensive background in electronic fundamentals plus knowledge of solid state phenomena and mathematics. Must be capable of participating in logic development with medium supervisors.

For details, write, outlining background and interests, to: Mr. R. E. Rodgers, Dept. 83003, IBM Corp., 550 Madison Avenue, New York 25, N. Y.

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LETTERS

Pilot Responsibility

Boy, I'll bet you are bored for the lack, isn't it? (Letter pilot editor, "Revels and Responsibilities," Feb. 16). But how can I get into the "21 gun salute." You look like a nice right out of my mouth. I heard more "merry" than that editorial than I did in check this morning.

ELIZABETHA TERT PILOT
Saville, Wash.

I think K. Hoot has a hell of a rope swing in editorial on pilot responsibility when he in turn is responsible responsibility in the language and facts for what is said editorial in reference to the CAA check of Northeast Airlines' pilots one morning in the "Tupper" column, another one concerning "airline accidents" and the other said poor souls being "too deficient" if no answer serves as merely being one of the common check pilots who missed the CAA set rule was Vt. Hoot not present on this check but on how the check forms do they please you? Consequently I can't imagine where a supposedly responsible editor takes it upon himself to use irresponsible facts and language in describing a presumed pilot's gross ability or lack of ability. These "merry," "cheerful" and "cheerful" men have many thousands of successful hours in pilot's command.

Now let's face it, a pilot's ability is a matter they hand upon the next pilot, most who is checking him, which is fact based upon a minimum standard set by both response and CAA. Now free of the one, Northeast pilots in general as the editorial was satisfied in the CAA but not recommended in further training in response check pilots to answer three passengers. We were also satisfied satisfactorily by the CAA that the Northeast Airlines' pilot check panel group is as well as the industry average as far as pilot experience is concerned.

So again, it is going to be safe and give a smiling a great idea of how about choosing more responsibility and respect for both facts and language used.

CURT W. JENNISON
Norfolk, Mass.

I have just read your very confident column, "Revels and Responsibilities" (AW Feb. 16, p. 11). The "merry" and "cheerful" I have read and I would like to suggest that a copy be put into the hands of every active pilot in the country for his future consideration.

B. J. VICKERS
General Supply Co.
Washington, D. C.

Your editorial "Revels and Responsibilities" (AW Feb. 16, p. 11) about pilot safety and poor pilot CAA statistics is one of the worst (p. 41) about the Electric crash at LaGuardia, made on information in the Feb. 5 issue. I was looking for answers.

American Week celebrates the explosion of the problem on the runway around the magazine's editorial columns. Address letters to the Editor, American Week, 220 W. 42nd St., New York 36, N. Y. Try to keep drivers under 500 words and give a generous identification. We will not print anonymous letters, but names of authors will be withheld on request.

The Feb. 8 *American Week* had your editorial "The Cost of Pilot Training" and Robert Scheidt's note about the same subject (p. 51). I still have the question: You list the pilots, their statistics, data of their training, and their views on approach to their problem. Also, you listed the CAA and FAA for inadequate facilities. There are two left management and reports from out of it. Some of the things you do about pilots may be justified, but I don't like it all.

Pilots are not up to perform well in maneuvers and procedures which they do not practice. This has nothing to do with their age, their race, their ability, or their intelligence. It does, however, have something to do with the amount of training and practice that can be afforded them.

It is not my business to defend airline pilots but I believe they are respected by both experience and in practice loaded on crowded flight in simulated emergency flight techniques with passenger aboard. It is possible for pilots to make several hundred hrs. as a commercial rate and receive under a 100 day term.

This too could be true, but it can also lead to false results with regard to greater proficiency in all phases of a pilot's profession.

Just as important that pilots have frequent opportunities to practice and be checked on their flight, not only on commercial on engine flight. Sometimes I wonder if all active pilots really have enough opportunity to fly. The results on their own time when pilots have fully and responded to emergencies. Thus there are also the CAA accident reports with their conclusions of pilot error.

You mentioned (Feb. 18) making the CAA report about the flight ending at Vandalia as an example. I had almost written in *American Week* CAA's or something about what I thought to be a rather odd and misleading as that report.

Investigation had dug into the pilot's old flight check records and found that the pilot had had a nervous difficulty in holding altitude in performing instrument flight. However, that was corrected by rechecks (practice). Later on the report offered the thought that the pilot's visual difficulties in hand climbing had to do with pilot's poor proficiency with a fix ahead.

Indeed a reader might wonder if this flight in pilot, even otherwise good and sound, should ever have been allowed to assume in the business because of his difficulty with time in state pilot flight check. As thought about this is that pilots can get into an even flatter if they do not have logical supervision to practice the cover stories. Of course, the economy at any

stage, less frequent reports pointed to that pilots can practice could have something to do with it.

Capt. Robert's review and beautiful review about the Electric tragedy undoubtedly point in favor of the accident as it was at first to happen. Also, Robert Scheidt's comment that "most crashes are the result of man, but they are occurring constantly." (AW Feb. 16, p. 17) speaks for itself.

However, a few facts from Robert Scheidt's review seem to stand out in point and what the accident should not have been of fact to happen. It is mentioned that the system was a "system" which about 10,000 hrs. of flight pilot time. Also, had eight more than 40 hrs. time on the Electric, including five scheduled New York Chicago round trips.

Other approximations have discovered that a pilot's last 120 hrs. on one hour equipment are the most critical. This last fact of a pilot's last 120 hrs. could reflect upon his ability. I should have our part the electric, the FAA, and the pilots on their guard.

My opinion is that the management and FAA allow a pilot in the safe stages of habit formation in one, but equipment to operate in such a "Grogginess hole" as his lack of use of LaGuardia 120 hrs. with his management. The pilot getting the last 120 hrs. could have been attended. Later on other pilots could get their experience thing with once first had electric, reported it.

Also there is the question as to what whether pilots are checked in habits because management cannot afford more extensive and comprehensive training.

Perhaps someone should think as to how the government is whether preventive and corrective measures with pilots. Scores practice and checks to that it would be a long spent hour the normally in operation a few hours of a pilot.

ROBERT E. TAYLOR
Washington, D. C.

While I am a rank amateur, I've been close to pilots and flying for many years, working with ALPA, with individual pilots with the Flight Safety Foundation, with some of the members of the CAA including recent appointments in England, Australia, New Zealand, etc. I have seen them take a deep interest and a very big more than the average knowledge of what's going on. In view of this I would like to congratulate you on your excellent editorial in the Feb. 16 issue of *American Week*. I have been personal conversations with pilots that the good, dedicated pilot is just in command about the problem of some pilots with two jobs, one flying and one commercial, and pilots with their work time on their hands are liable to have a too casual approach as you put it to the task of spending their as much carefully as you put it.

In view of the probability of getting reports of this excellent editorial which I would like to put in the hands of all commercial pilots, not through this but "sign" the dedicated pilot himself who is concerned about his profession.

HOOR S. KENN, M.D.
Hammonton, Ind.

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(Continued on page 11)





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